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WHEAT AND ITS CULTIVATION.

SEED WHEAT AND ITS TREATMENT.

No. XII.

(Continued from page 141.)

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An important factor in determining the yield of a wheat crop is the care bestowed on the selection and treatment of the seed.

The requirements of good seed wheat are that it should be true to name, *i.e.*, free from admixture with other wheat varieties. It should also be free from weed seeds and diseased kernels; and should possess a high percentage of germinable, healthy grains, derived from vigorous and prolific plants. Moreover, precautions should be taken with such seed to protect it, by some process of pickling, from such fungoid diseases as smut or bunt.

In the choice and treatment of seed wheat four points require consideration.

1. The careful choice of varieties suitable to the soil and climatic conditions of the farm.
2. Every effort should be made to raise the productive capacity of such varieties by systematic selection.
3. The grain chosen for seed purposes should be thoroughly graded.
4. Precautions should be taken against such diseases as bunt by the use of suitable fungicides.

Choice of Varieties.

Inasmuch as the soil and climatic conditions differ widely in the various parts of the State, considerable care is necessary to choose such varieties as are adapted to the specific conditions of the farm. Some varieties are very late in maturing, and possess protracted growing periods. These are unsuitable for dry hot districts where hot winds

in early Spring are of frequent occurrence, though they may prove of great value in districts with heavy Spring rainfall. In moist coastal areas the growing of rust resistant varieties is a matter of importance. Besides the choosing of varieties of general suitability for the local conditions, it is also necessary to bear in mind that among wheats possessing the same general characters and habits of growth, there are some, under specific soil conditions, which regularly excel others of the same class in their productive powers. The difference in the yield between two varieties of wheat grown on the same farm under precisely similar conditions is often more than sufficient to pay the interest on the value of the land on which the varieties were grown. This has been demonstrated time after time in the departmental tests and on private farms, and has been again confirmed by last season's tests at the Rutherglen Experiment Farm and the Longerenong Agricultural College.

At Longerenong, the average yield of fourteen varieties of wheat grown side by side, under precisely similar conditions last season, was 30.7 bushels—the lowest being 20.9, whilst the highest was 43.2 bushels. Again, whilst the average yield of twenty varieties at the Rutherglen Experiment Farm during the past year was 26.5 bushels, the lowest was 11.7, whilst the highest was 42.9 bushels.

The choice of the variety will also be determined by the purpose for which the crop is required, whether for green forage, ensilage, hay, or for grain. The main requirement of a variety for green forage or ensilage is that it should give a heavy tonnage of succulent material.

Tall growing, flaggy varieties, with more or less solid straw, and preferably of quick growing habit, give good results for these purposes. If such varieties are free from coarse beards, retain their colour well when cured, and possess palatable sweet straw, they make useful hay varieties. In densely populated countries, where straw is of considerable commercial value, it is essential that varieties grown for grain should give a heavy cut of straw, as well as a high yield of grain.

There is less need for grain wheats to possess such qualities in Australia since the straw is of little commercial value in remote wheat areas. For this reason short-strawed, upstanding varieties like Federation, which give high yields of grain and comparatively small yields of straw, are growing in favour.

The qualities of the varieties more commonly grown for hay, forage, and grain purposes have already been discussed.*

Change of Seed.—It is commonly held that a change of seed is necessary from time to time in order to counteract the assumed tendency of wheat from degenerating. We often hear it said that a certain variety of wheat has "run out." This is an expression of the belief that the continued growing of a given variety of wheat under unvarying soil conditions for a number of years results in the deterioration of that particular variety to such an extent as to render a change of seed absolutely necessary. In other words, it is the practical farmer's expression of the belief that varieties of wheat under ordinary conditions of cultivation tend to degenerate. Such a belief would appear to find confirmation in the fact that many of the varieties formerly

grown have been displaced from general cultivation by newer varieties. On the other hand, there are many varieties which have been in general cultivation for over thirty years, and which maintain their vigour unabated. There is no reason to believe that this tendency to degenerate is a normal characteristic of wheat. Indeed, there is no reason why, with careful selection and propagation, the prolificacy of a given variety should not only be fully maintained, but even considerably increased.

Certainly, it is difficult to see how the prolificacy of any given variety can be maintained at a high level if no care is taken to preserve the very best of the crop for the next season's seed, and if careless and slipshod methods of cultivation are allowed to prevail. It is still more difficult to see how a careless grower can improve matters by securing seed from persons equally as careless as himself.

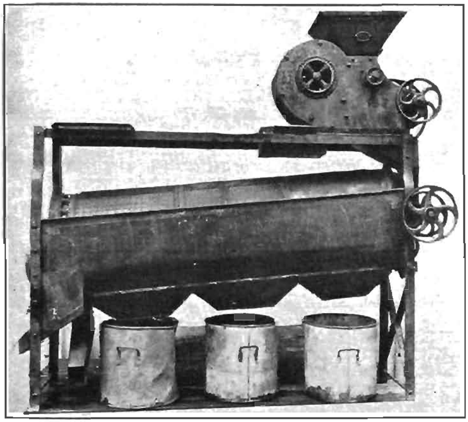


Plate 1.
Mayer Wheat Seed Grader

Unless the change be for the purpose of obtaining a better variety, or more vigorous seed, or for seed that has been subjected to careful and systematic selection, there can be no advantage resulting from change of seed. Indeed, if it be merely a promiscuous exchange, it is more than probable that the change would be a decided disadvantage. This would happen in all cases, for example, in which wheat is transferred from a favorable to an unfavorable environment. Again, in extreme cases, such as would happen, *e.g.*, in introducing new varieties from foreign climes, some years must elapse before the new seed becomes acclimatised.

Moreover, such change of seed is often the cause of introducing new weed pests and diseases from one district, State or country to another. *The balance of evidence goes to prove that farmers should* rather rely on locally developed seed, and should give more attention to their own seed, and the prevalent idea that the mere change of seed gives good results would appear to be founded more on opinion than upon well ascertained fact.

Each progressive grower must of necessity be an experimentalist—constantly observing and testing the behaviour of the varieties grown on his own farm and in his district. The poorer varieties are thus gradually eliminated, and the best varieties retained for the bulk of the farm area. Having determined the most suitable variety or varieties for the farm conditions, deliberate steps should then be taken to improve these chosen varieties by systematic selection and regular grading.

IMPROVEMENT BY SELECTION.

There is no need to dwell here on the value for systematic selection for the improvement in prolificacy in our grain crops. This subject has been already considered in some detail in the Article IX. on "Improvement of Wheat by Selection."*

To the instances there quoted illustrating the value of selection in increasing the prolificacy of a given variety may be added some results from the past year's experimental plots. At the Longerenong Agricultural College, Federation seed which had been selected for three consecutive years on the lines laid down in Article IX. was sown alongside graded seed of the same variety which had been procured locally.

Though the two plots were sown under similar conditions with 1 cwt. of super and 59 lbs. of seed per acre each, the selected seed yielded 43.2 bushels per acre, as against 34.5 bushels of ordinary seed of the same variety. It is interesting to note, moreover, that there were fifteen manurial plots sown with graded Federation seed near by, with various dressings of manure, and the highest yield was 34.7 bushels.

GRADING THE SEED.

The belief that shrivelled, pinched grain was as good as plump grain for seed purposes was very commonly held some years ago. Carefully conducted experimental work has demonstrated beyond doubt, however, that plump grain is greatly superior to shrivelled grain in productive power.

At the Ontario Agricultural College, Canada, Professor Zavitz has conducted some interesting experiments extending over six successive years with Winter wheat, and eight years with Spring wheats. Large plump grain of Winter sown wheat gave 46.9 bushels per acre, as against 39.1 bushels from shrivelled grain of the same variety, *i.e.*, 7.8 bushels per acre extra. Again, with Spring wheats, the difference amounted to 5 bushels in favour of graded grain, the large plump grain yielding 21.7 bushels, whilst the shivelled grain of the same variety gave 16.7 bushels.

An experiment was carried out at the Wyuna Experiment Farm last season to test the effect of grade of wheat on the yield. A parcel of

* Wheat Improvement, *Journal of Agriculture*, January, 1913, p. 38.

Federation seed of the previous harvest was passed through the Mayer grader shown in Plate 1. Four samples of grain resulted—Grade I., Grade II., Grade III., and screenings. The latter were rejected.

A sample of the seed just as it came from the harvester was reserved for a control plot and labelled "Normal seed." It consisted of grain of varying size, containing chaff, stems, and a small proportion of cracked and pinched grain. The grader separated the wheat into four grades. Of these the first grade consisted of fine plump

I. Grade.

II. Grade.

III. Grade.

"Normal."

PLATE II.

grain of very uniform size. Grade II. was slightly smaller in size, but very uniform and fairly plump. There were very few defective grains. Grade III. consisted for the most part of small grain, approximately half of which was somewhat pinched, and a small proportion of cracked grain. Grade IV., which consisted of white heads, chaff stems, cracked and pinched grain, was rejected.

Equal quantities of these grades, viz., Normal, Grade I., Grade II., and Grade III., were sown with the drill on 5th June, 1912, at the rate of 49 lbs. of seed and 81 lbs. of superphosphate per acre.

Plate 2 conveys an idea of the appearance of each sample. A more accurate picture of the relative sizes and weights of these various grades may be gathered from Table I., which gives the weight, volume, *and density of the average kernels of each grade.*

TABLE I.

AVERAGE WEIGHT, VOLUME, AND DENSITY OF GRADED SEED, WYUNA EXPERIMENT FARM, 1912.

Grade of Sample.	Weight of 100 kernels (grams).	Average weight per kernel (grams).	Volume of 100 kernels (cubic centimetres).	Average volume per kernel. (cub. cm.).	Specific Gravity of Seed.
1. "Normal" Seed (from harvester)	3·117	·0311	2·398	·023	1·33
2. Grade I ..	3·972	·0397	2·911	·029	1·36
3. Grade II ..	2·883	·0288	2·204	·022	1·30
4. Grade III ..	1·978	·0197	1·547	·015	1·27

Very little difference was observable in the growth of these plots, except that of Grade III., which appeared to be more backward than *the others. The plots were harvested on 3rd and 4th January, 1913,* with the following results:—

TABLE II.

YIELDS OF GRADED SEED PLOTS, WYUNA EXPERIMENT FARM, 1912.

—	Amount of seed per acre.	Superphosphate per acre.	Date of Sowing.	Date of Harvesting.	Yields per acre.
Grade I ..	49 lbs. ..	81 lbs. ..	5th June ..	3rd Jan. 1913	**28 bush. 6 lbs.**
Grade II	.. ..	.. ..	.. ..	.. ..	**27 " 53 "**
Normal Seed ..	.. ..	.. ..	.. ..	4th Jan., 1913	**25 " 27 "**
Grade III	.. ..	.. ..	.. ..	.. ..	**23 " 50 "**

From the results of this experiment it is evident that grain obtained from the harvester may be divided into at least three grades of seed, of which two grades give yields considerably in excess of the normal seed, whilst the yield of the third grade is considerably below that of the Normal seed.

Grade I. gave an increased yield of 2 bushels 39 lbs. per acre over the ungraded seed, which at 3s. 4d. per bushel equals an increase of 8s. 10d. per acre. Similarly, Grade II. gave an increase of 2 bushels *26 lbs. per acre, or 8s. 1d. per acre over the ungraded seed.*

On the other hand, Grade III., which consisted mostly of pinched grain, with a small proportion of cracked grain, gave a decreased yield of 1 bushel 37 lbs. per acre, that is a loss of 5s. 4d. per acre compared with the ungraded plot. Hence, for the trifling expenditure of, say, 6d. per bushel—the cost of grading the seed—less than 6d. per acre, the grain from the harvester may be separated into three distinct grades of seed, two of which give increased yields worth 8s. 10d. and 8s. 1d. per acre, and a low grade sample which would normally be

But there are other advantages accruing from grading of seed wheat besides the increased profit obtained per acre.

An ordinary sample of grain from the harvester always contains a proportion of cracked and broken kernels. The actual amount will vary with the skill of the harvesting operator, and with the setting of the machine.

This cracked and broken grain has little or no value for seed purposes, since it either will not germinate, or, if it does germinate, it gives rise to spindly weak plants of low productive power. This grain is, however, of value for feed purposes. Now, by the process of grading, the grain of considerable commercial value for feed, but of negligible value for seed, is separated and saved. The saving thus effected will more than cover the cost of grading, apart altogether from the higher productive value of the graded product.

If to these advantages we add that the use of a good grader will separate weed seeds, grains of other cereals, and remove rubbish, diseased and damaged grain, and steadily improve the quality and prolificacy of the seed each year, it will readily be admitted that the advantages accruing are sufficient to justify the cost of installation of a good machine on the farm. The capacity of many of the machines now on the market is such that the whole of the seed required for the seeding of a farm of average size may be graded in a few days. Under these circumstances it would seem feasible for a group of farmers to co-operate in the purchase of such a machine, and use it in rotation after harvest. As an alternative, arrangements might possibly be made by country flour mills to install a machine, and undertake the grading of seed for the farmers in the vicinity at a nominal cost.

Pickling the Seed.

A farmer who has taken the care to choose suitable varieties of wheat, and to improve such varieties by systematic selection and careful grading, should not run the risk of omitting to treat the seed for smut (*Tilletia tritici*). Pickling of the seed for prevention of smut is now regarded as a regular part of the farm routine.

Much effort has been spent on the production of bunt-proof wheats, and it would appear that already a considerable amount of success has been obtained. Florence and Genoa, *e.g.*, have been shown in experimental trials to be practically immune from smut, whilst wheats like Medeah and Huguenot have long been known to be smut-resistant. The same cannot be said, however, for the varieties in general cultivation, for some of the most prolific yielding wheats we grow are very susceptible to smut.

The advantages of securing a bunt resistant prolific wheat must be manifest. The process of pickling would be unnecessary, and the time, labour, and expense involved in the operation would be saved to the farmer. Seeing that the quality of smut-resistance has already been observed in a few varieties, it should not be difficult to impart the quality to prolific, but more smut-susceptible, varieties.

The cost of the actual pickling operations is not great, but as a considerable portion of seed is destroyed by most of the fungicides in general use, it follows that the total cost, including the damaged seed, is very considerable. The production of a bunt-proof prolific variety

is, therefore, a legitimate aim of the wheat breeder, and it is not too much to expect that such a variety will materialize in the future.

All pickling methods depend on the destruction of the spores of the fungus by suitable fungicides, or by hot water treatment. An ideal fungicide for pickling purposes would require to be (*a*) cheap, (*b*) effective, *i.e.*, capable of destroying all the spores adhering to the grain, (*c*) capable of preventing reinfection of the seed, (*d*) without effect on the germination of the grain. The fact that so much controversy has arisen regarding the various fungicides on the market is proof that the ideal fungicide has not yet been obtained.

The most common fungicides used are (1) Bluestone, (2) Formalin, (3) Fungusine, a proprietary preparation. Immersion of the seed in hot water at 132 deg. Fahr. for ten minutes has been recommended, and it is efficient, but, with the rush of work at the seed time, it proves in practice a cumbersome, slow, and unwieldly process, and is not likely to be generally adopted.

Bluestone is a very popular fungicide, and when properly used it is very effective. The stronger solutions of bluestone, not only lower the germinating capacity of the seed, but also delay its germination. The strength of the solution recommended for ordinary use is 1½ per cent., *i.e.*, 1½ lbs. of bluestone to 10 gallons of water, and the seed should be immersed in this for five minutes. Stronger solutions than this are unnecessary in ordinary farm practice, whilst a weaker solution, namely, 1 lb. bluestone to 10 gallons water, may often be used with advantage. If the seed is badly smutted, stronger solutions should be used, more particularly to avoid possible reinfection of the seed. The farmer should, however, make it his business not to sow badly smutted seed, but at all times to reserve the cleanest and best of the crop for seed purposes.

The use of a solution of definite strength is much to be preferred to the common method of using a handful or two of bluestone dissolved in a variable quantity of water to each bag of seed. It is necessary to realize that the strength or concentration of the solution is all important for successful work, and that there is an optimum concentration which gives the best results. Below this strength the fungicide is ineffectual, and with higher concentrations the germination is interfered with. From time to time various substances have been recommended to lessen the corrosive action of the bluestone, and among these, the use of lime and salt have been advocated, but the results of experimental work so far tend to show that there is no advantage gained by the use of these substances. When bluestone is used as a pickle the receptacles used must, of course, be constructed of some material other than iron. A convenient way of dissolving the bluestone is to tie the requisite quantity of bluestone, previously weighed, in a hessian bag and suspend it just beneath the surface of the water. If thrown to the bottom of the vessel it takes some considerable time to dissolve, even if the pickle is kept agitated. Two points of practical importance will be discussed later.

(*a*) Will seed pickled with bluestone and formalin retain its germinating power and vigour if not sown immediately?

(*b*) Is there any danger of reinfection if the seed is pickled with bluestone and formalin?

Formalin has been known for many years to be an effective fungicide for pickling wheat. It is a solution of formaldehyde gas in water, and the usual concentration of the commercial article is 37-38 per cent. Some years ago it was a somewhat difficult matter to secure reliable samples of formalin. There are now on the market, however, a number of brands which may be used with confidence. The strength of solution recommended for ordinary farm work is 1 lb. of formalin to 45 gallons of water, or 1 in 450. This effectively prevents smut, and does not interfere seriously with the germination. Stronger solutions than 1 in 400, *i.e.*, 1 lb. of formalin to 40 gallons water, are not to be recommended, on account of the depressing effect on the germination. On the other hand, solutions of 1 in 500, have given complete satisfaction under experimental and ordinary field conditions.

Formalin is a cheap fungicide, is readily prepared, and has not the corrosive action characteristic of bluestone.

Fungusine is a proprietary preparation which has been used as a fungicide for smut, but considerable difference of opinion exists as to its merits. Its main constituents are white arsenic and crude phenyle, and it is put on the market in the form of a bulky powder.

There seems to be little doubt that fungusine has not that deleterious effect on the germination of the seed that is observed when the seed is pickled with bluestone and formalin. Indeed, in nearly all cases in which fungusine has been used, the germination has been, for some reason or other, materially stimulated by the process of pickling.

In recent experiments it has acquitted itself well as a smut preventive, and for preventing reinfection after pickling. In using this fungicide, 2 lbs. of the mixture is mixed with 2 gallons of water, and the liquid poured over the contents of two bags of seed, and thoroughly mixed.

Methods of Pickling.

Seed wheat may be pickled with formalin or bluestone either by immersion for a stated time in a solution of given concentration, or by pouring the solution over several bags of wheat on a cement floor, and shovelling over the mass until every grain has been thoroughly wetted with the solution. Pickling by immersion is less expeditious, but on the whole it is more efficacious. The whole of the grain comes into contact with the pickle, especially if the grain is agitated within the pickle. If the grain is held in a suitable vessel, agitation dislodges any bunt balls that may be present, and causes them to float on the surface of the pickle, from which they may be skimmed off, and the danger of reinfection of the seed avoided.

There are several patent pickling machines now on the market which enable the grain to be very conveniently and expeditiously handled, and much of the old-time drudgery associated with pickling may thus be avoided.

An effective type of pickling apparatus consists of a large wooden cask to hold the bluestone or formalin solution, and a steel upright to which is attached a pulley. The seed wheat is placed in a perforated copper vessel, fitted with a false bottom, fastened by a spring. The copper vessel filled with seed is lowered into the cask by means of the pulley and kept immersed in the solution for the

specified time. It is then raised, and the solution allowed to drain through the perforations back into the cask. After draining, the copper vessel is swung round over an open bag attached on a frame to the side of the cask, the spring holding the false bottom is released and the grain drops into the bag. The false bottom is then restored and the copper vessel again charged with seed.

The barn floor method of pickling enables the work to be done very quickly, and, with good clean seed, it is a very convenient method to adopt. When fungusine is used, indeed, the barn floor method of pickling is the only one possible. The disadvantage of the method is that it is not possible to remove bunt balls that may be present, and reinfection is inevitable if the seed is at all smutty.

The question of reinfection of the seed is of some practical importance. It must be understood that while the three fungicides mentioned all have the power of destroying loose spores they are unable to destroy the vitality of the spores in the interior of any unbroken bunt balls that may be found in the seed.

These bunt balls consist, of course, of hundreds of thousands of smut spores enclosed within the firm protective shell which forms the outer integuments of the kernel. So long as these bunt balls remain unbroken, the fungicide is unable to destroy the spores in the interior of the ball, unless of course the ball be subjected to prolonged immersion in the fungicide. Hence, unless these bunt balls be removed from the seed they are a source of danger, since they are readily broken in passing through the force feed attachment of the drill, and the spores in the interior of the ball are liberated, and thus reinfect the seed. The question now arises as to whether the thin coating of the fungicide adhering to the grain is capable of preventing such reinfection.

In order to gain definite information on this point, a set of experiments was conducted last season at the Longerenong Agricultural College.

A parcel of Federation wheat was uniformly infected with bunt by breaking a sufficient number of bunt balls over the grain to make it thoroughly dark with smut spores.

A small quantity of seed was left untreated for check purposes.

The smutted seed was then divided into small lots and pickled by immersion in formalin and bluestone solutions of two fixed strengths. A small quantity was also pickled with fungusine. After pickling, each lot was divided into two portions. One-half of each lot was thoroughly reinfected by breaking an equal number of bunt balls over the seed.

The seed of the untreated, pickled, and reinfected samples was then sown, and the germination of each plot noted, as well as the percentage of bunty plants, the total yield per plot, and the total weight of grain per plot. Each plot was sown with 200 grains.

From the results of this experiment it is clear that of the three fungicides tested, namely, bluestone, fungusine, and formalin, formalin is least able to prevent reinfection of the grain. Comparing plot 12 with plot 6, and plot 13 with plot 7, it will be seen that by reinfecting the seed the percentage of bunty plants has been increased from 0.0 per cent. to 64.3 per cent. and from 2.85 per cent. to 66.05 per cent. respectively, whilst the weight of grain per plot has been lowered from

Table III. gives the results obtained at the Longerenong Agricultural College.

TABLE III.

Showing the extent to which Re-infection takes place with seed pickled with Fungicides of varying strengths.

LONGERENONG AGRICULTURAL COLLEGE.

Number of Plot.	Treatment.	Germination. Percentage of Plants Above Ground.					Percentage of Plants Matured.	Percentage of Bunty Plants.	Weight of Produce.	Total Weight of Grain.
		1st Week. 1. 7. 12.	2nd Week. 9. 7. 12.	3rd Week. 16. 7. 12.	6th Week. 6. 8. 12.	9th Week. 30. 8. 12.				
									lbs.	lbs.
1	Clean	44·0	52·5	63·0	63·0	64·0	64	0·0	12·0	5·0
2	Smutted	47·0	55·5	64·0	63·5	60·5	56·5	51·3	11·0	4·0
3	Bluestone, 1 per cent. ..	39·5	57·5	68·5	74·5	75·0	68	8·8	15·0	5·0
4	Bluestone, 2 per cent. ..	36·5	62·5	71·5	79·5	77·0	72·5	2·06	13·0	6·5
5	Fungusine	71·5	77·5	86·5	85·5	83·0	79·5	5·66	16·0	6·5
6	Formalin, 1—300 ..	10·0	24·0	31·5	43·0	34·5	56	0·0	8·5	3·3
7	Formalin, 1—400 ..	33·5	33·5	47·5	63·0	58·5	52·5	2·85	14·0	5·5
8	Clean (Check Plot) ..	46·5	54·0	62·0	66·5	65·5	52·5	0·0	15·0	5·5
9	Bluestone, 1 per cent., *Reinfected*	56·0	73·5	75·0	85·0	82·5	75	18·6	15·0	4·5
10	Bluestone, 2 per cent., *Reinfected*	30·5	53·0	62·5	74·0	71·5	66	4·5	14·5	5·5
11	Fungusine, *Reinfected* ..	69·5	71·0	81·5	82·5	80·5	76·5	10·9	18·0	6·0
12	Formalin, 1/300, *Reinfected*	14·5	27·5	43·0	51·0	41·5	36·5	64·3	9·0	2·5
13	Formalin, 1/400, *Reinfected*	37·0	41·0	52·5	60·0	59·5	54·5	66·05	11·5	3·1
14	Clean (Check Plot) ..	58·5	65·5	72·0	81·0	81·0	69·5	0·0	15·5	5·5
15	Smutted	16·5	25·1	31·0	39·5	36·0	29·5	40·07	7·0	3·0

The other two fungicides are far better able to withstand reinfection. Thus in the case of bluestone, plot 3 treated with a 1 per cent. solution gave 8.8 per cent. of bunted plants and a total grain yield of 5 lbs. grain. The same seed when reinfected with smut spores (plot 9) gave 18.6 per cent. of bunted plants and a decreased grain yield of 4.5 lbs. per plot.

Again, a solution of 2 per cent. bluestone gave a percentage of bunted plants of 2.06 and a grain yield of 6.5 lbs., while the same seed when reinfected with smut spores had 4.5 per cent. of smutted plants and gave a total yield of only 5.5 lbs. Somewhat similar results were obtained with fungusine (plots 5 and 11). The effect of reinfection increased the percentage of smutted plants from 5.66 per cent. to 10.9 per cent., and decreased the grain yield from 6.5 to 6 lbs. per plot. Confirmatory results were obtained at Rutherglen. It will be seen, therefore, that in all cases reinfection of the seed led to an increased percentage of smutted plants and a decreased grain yield, and that these effects were by far more pronounced in the case of formalin than with bluestone or fungusine.

It follows from these results that in pickling with formalin the greatest care should be taken to see that any unbroken bunt balls are removed during the process of pickling in order to prevent possible

reinfection. Moreover, from these results it would appear that formalin is likely to be less satisfactory than either bluestone or fungusine when the sample is badly smutted, and for reasons already given, the barn floor method of pickling is more risky with formalin than with bluestone.

An interesting point in connexion with pickling is whether it is necessary to sow seed pickled with formalin or bluestone immediately after pickling, or whether any ill-effects are produced on the germination or vigour of the plants by delaying the sowing. It is contended by some that in pickling with formalin or bluestone the seed should be sown immediately. Others affirm that seed may be pickled months before seeding without any harmful effects. In order to gain some information on these points a set of experiments was carried out at the Rutherglen Experiment Farm. A parcel of seed of the 1911 harvest was thoroughly smutted, and portions of the seed were pickled with formalin, 1 in 400, and bluestone, 2 per cent., on 26th February, exactly fourteen weeks before the seed was sown. Duplicate samples were pickled with the same solution at periodical intervals up to 1st June, and on 3rd June all the pickled lots were sown simultaneously.

TABLE IV.

Showing the effect of delayed sowing of Pickled grain on the germination and yield of wheat.

RUTHERGLEN EXPERIMENT FARM.

Plot.	Treatment.	Date of Sowing.	Percentage of Plants Above Ground.		Plants Matured.	Total Weight of Crop.	Total Weight of Grain.
			29th June	5th July.			
			%	%		lbs.	lbs.
1	Untreated	3rd June	75	85	81·5	14·5	5·7
2	Smutted Seed ..	..	30	53·5	54·0	11·0	3·6
3	Formalin, sown immediately after pickling	..	16·5	46·5	52·5	9·1	3·5
	Formalin Sown—						
4	1 week after pickling	..	32·5	61·5	59·0	12·0	4·5
5	2 weeks after pickling	..	29·0	41·5	52·5	11·0	4·2
6	4	..	19·0	37·5	42·0	8·0	3·05
7	6	..	23·5	46·5	48·0	9·5	3·5
8	10	..	25·0	38·5	41·0	7·5	3·05
9	12	..	11·0	31·0	38·5	6·5	2·6
10	14	..	20·0	40·0	43·5	7·0	2·65
	Bluestone Sown—						
11	Immediately ..	..	58·5	74·5	70	10·0	4·1
12	1 week	..	33·0	64·5	72	11·0	4·5
13	2 weeks	..	33·5	65·0	70	10·0	4·25
14	4	..	54·0	70·0	78·5	9·25	3·5
15	6	..	36·0	60·0	75·5	9·25	3·6
16	10	..	15·5	40·0	66·5	9·0	4.0
17	12	..	26·0	61·0	63·5	8·9	3·8
18	14	..	14·5	29	52·0	7·75	3·2
19	Untreated (Check Plot)	..	56·0	74·5	72	13·0	5·1

While the results do not show that regularity which might be expected in a carefully conducted field trial, it would appear that the best practice to follow is to sow the grain within a week or two weeks of pickling. During this period the germination and the vigour of the plots, as expressed by yields of grain, appear to be at a maximum, and these gradually fall off as the length of time between pickling and sowing increases. This is more noticeable with formalin pickled seed than with bluestone pickled seed.

The results may be more clearly seen by dividing each of the formalin and bluestone series of plots into two sections of four plots each and comparing the yields of grain and the germination percentages. Thus the average percentage of plants reaching maturity in plots 3, 4, 5, 6, representing batches of seed sown up to four weeks before pickling, works out at 51.5 per cent., as compared with 42.75 per cent. for the remaining four plots pickled from 6-14 weeks before sowing. Moreover, the average yield of grain from the first set work out at 3.84 lbs. per plot, as against 2.95 lbs. from the last batch.

Turning now to the bluestone series, the differences between the first and second sections is not nearly so marked as with the formalin series. Thus the average percentage of plants reaching maturity with the first section (plots 11, 12, 13, 14) is 72.6 per cent., as compared with 64.4 per cent. of the second section (plots 15, 16, 17, 18). Again, the yield of the first section averages 4.08 lbs. per plot, as compared with 3.65 lbs. per plot for the second section.

Finally, it may be noted that the untreated plots far outstrip all other plots both in rapidity of germination, total plants reaching maturity, and, what is far more important, in total produce and grain per plot. One needs only to look at the figures for the two check plots to see that formalin and bluestone of the strengths generally recommended, formalin 1 lb. to 40 gallons, and bluestone 2 lbs. to 10 gallons, delays the germination, lowers the percentage of plants which reach maturity, and depresses the yield per acre.

The seed for these experiments was pickled by the Vegetable Pathologist, Mr. C. C. Brittlebank, and the planting and recording of the results by Field Officers, Mr. T. M. Whelan, of the Rutherglen Experiment Farm, and I. M. Tulloh, of Longerenong Agricultural College.

(To be continued.)

THE FRUIT TRADE OF VICTORIA.

ITS PRESENT STATUS FROM A COMMERCIAL STAND-POINT.

(Continued from Page 178.)

PART VI.

OVERSEA FRUIT EXPORT.

By E. Meeking, Senior Fruit Inspector.

The application of low temperatures to fruits under different methods of carrying conditions, both in cool storage and during transportation, has been the subject of long and careful investigation in America. Various types of refrigerator car have been designed, and their efficiency thoroughly tested. Thermograph records of temperatures and variations inside the cars during transportation of fruit have been kept. The different results of shipping fruits under the following methods have been recorded:—(*a*) In ordinary ventilated cars; (*b*) under regular icing without pre-cooling; (*c*) in insulated trucks with pre-cooling of fruit; (*d*) pre-cooling and shipping under initial icing only; and (*e*) pre-cooling and shipping under regular icing.

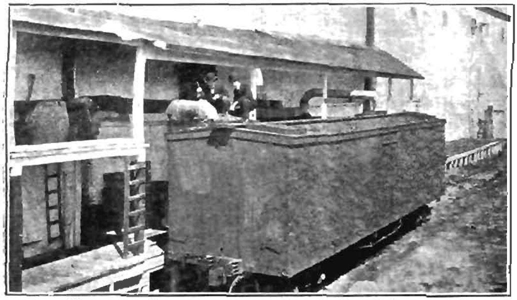


Fig. 1.—Cooling oranges in car, Los Angeles, Cal., 1905.

The results of these experiments show that a minimum of variation occurs in fruit car temperatures when fruit has been pre-cooled before loading and transported under regular icing throughout the trip. Fruit pre-cooled and forwarded under initial icing only, or fruit forwarded without pre-cooling and under regular icing has been shown to vary considerably more in temperature than by the first-named method. The greatest variation occurs in cars ventilated in the ordinary way without icing during transit. The following illustrations, taken from Bulletin No. 123, 1908, Bureau of Plant Industry, Department of Agriculture, U.S.A., will serve to illustrate the variations in temperature when fruit has been forwarded under the different conditions mentioned. These experiments were conducted in connexion

with shipments of oranges from San Bernardino to Jersey City, N.Y., a trip which occupies, on an average, from eleven to fifteen days. Of course, no rail trip on this Continent occupies so great a length of time as the one under notice, if we except fruit transferred from other States to Victoria, or *vice versa*. Even in connexion with transport within the State only, however, fruit often remains in the railway trucks for three, four, or five days before shipment. The records in Fig. 6 . . . . showing fruit forwarded under ordinary ventilation, clearly indicate that even in the short space of time occupied *in forwarding our fruits from the country centres to the ship's* side for export, say, from three to five days, a great rise of temperature and constant hastening of ripening processes and general deterioration is likely to occur. This is especially so in hot weather. This would seem to indicate that wherever practicable it is preferable to pre-cool fruits as near as possible to the point of picking, and to forward in cars under regular icing. It is more especially, however, in con-

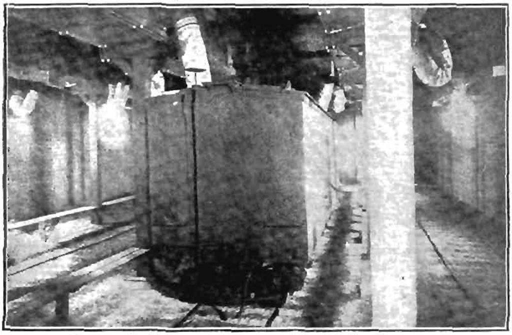


Fig. 2.—Cooling bananas in car, Springfield, Mo., 1905.

nexion with the local and Inter-State transport of our soft fruits, such as apricots, peaches, grapes, plums, &c., that the need for a proper system of refrigerator car transportation exists. The saving of the waste and loss which yearly occurs during the transportation and marketing of these fruits would more than compensate for the small extra charge which would be incurred in the matter of freight. Unfortunately, no statistics are available to show the amount of loss which occurs each season through ripening and decay of our soft fruits, and which is mainly brought about by handling, transporting, and marketing under improper conditions; but there is little room for doubt that fully 10 per cent. of these fruits are in many seasons sacrificed on this account.

Types of Cars used in Victoria and America.

In connexion with the transport of oranges from California to the Eastern States, the type of car in general use differs from the type

usually employed in Victoria for the conveyance of fruits, inasmuch as ice-cars are used with ice-bunkers placed at the ends of the truck, and hold each from 2 to 2½ tons of ice, and are usually iced at various assembling points in California after the fruit is loaded, and re-iced during transit according to requirements.

A standard car measures 40 feet in length. The freight and refrigerator charges vary according to the section of country where the fruit is shipped and the weight of fruit per car. For instance, *the rate to Chicago from California on a car of* 24,190 lbs. is 54 dol. 67 c., and to New York 65 dol. 61 c. The rate on a car of 27,650 lbs. (which is the weight of a standard car of 384 boxes) is 62 dol. 50 c. to Chicago, and 75 dol. to New York.

In this State, ice cars are not used under any circumstances for fruit transportation, as in the type of car used for the conveyance of

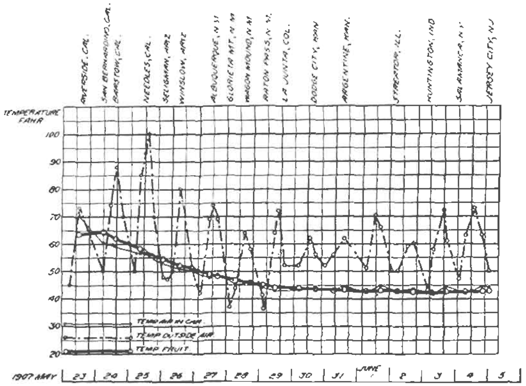


Fig. 3.—Diagram showing the average temperature record of two carloads of oranges shipped under regular icing, May, 1907.

perishable products generally (butter, meat, rabbits, &c.,) the ice-bunkers are placed in the top of the car, and cannot, on this account, be safely used for fruit transport. For conveying consignments which have been pre-cooled at country centres, special insulated trucks are used. These contain no ice-bunkers; but, as the cars are cooled before loading, and as the fruit itself is chilled before being loaded, it is considered that the car temperature varies very little, even during transportation over long distances.

Among the many new types of car which have ben introduced on the American Continent, and of which trials have been made, may be mentioned portable pre-cooling plants which have been fitted up to pre-cool fruit grown away from centres where no stationary pre-cooling plant can be erected, and also insulated cars with provision

made for supplying these with cold air from the stationary refrigerator plants at different points during transportation. These experiments are still in progress, and the results as to the best methods to be employed in pre-cooling and in refrigeration during transit have not yet been determined. With respect to some fruits, indeed, many ideas regarding the utility of pre-cooling have recently been much modified. This is especially the case so far as the transportation or cool storage of grapes is concerned. No system of cool storage which has yet been devised would appear to check, to any material extent, the effects of preliminary rough handling and incorrect methods of packing grapes.

Picking, Packing, and Handling Experiments.

In the Bulletin before-mentioned, the result of a series of experiments in connexion with the influence on the keeping quality of fruit,

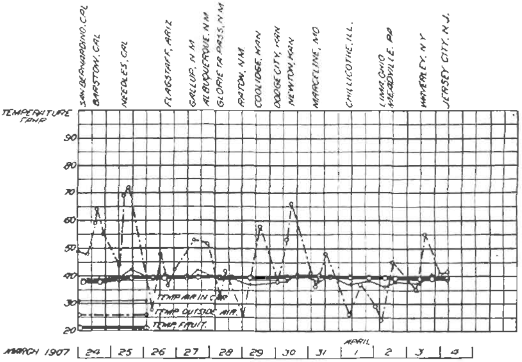


Fig. 4.—Diagram showing the temperature record of a standard carload of 384 boxes of oranges, precooled and shipped under regular icing, March and April, 1907.

of various methods of picking, packing, and handling is given. The effect of picking at various periods of the year has also been carefully noted, and results published. Summed up, it may be stated that fruit, if sound when picked from the tree, will keep longest if handled so carefully as to avoid abrasions or punctures of the skin, and that fruit showing mechanical injuries develops a maximum of decay. The experiments quoted have been carried out with respect to oranges; but the results of experiments carried out with other fruits show that the same rule applies to them.

Of course, the application of up-to-date methods of pre-cooling and cool-storing fruits is necessary for successful transportation; but the grower and packer bear their share of responsibility in exercising proper and necessary care in picking and packing. As before stated, fruit to be kept for any length of time must be free from bruises,

abrasions, or punctures to the skin. Fruit with broken skin will keep longer if cool-stored than would the same fruits if stored under

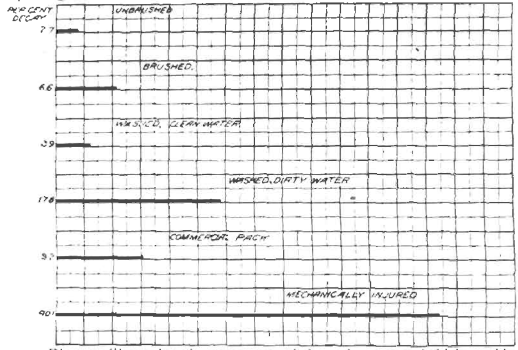


Fig. 5.—Diagram illustrating the percentage of decay in oranges held in packing houses, 1907.

ordinary conditions; but the ideal to be aimed at is to harvest fruits without mechanical injury and to apply proper cool-storage methods

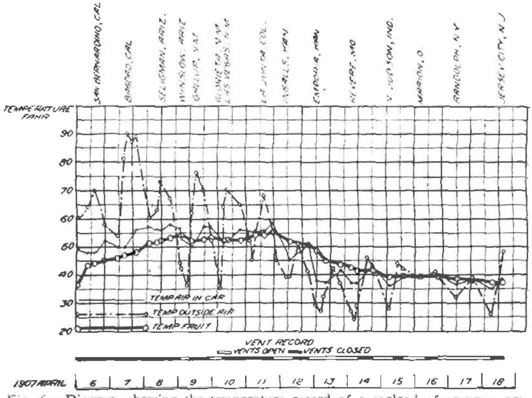


Fig. 6.—Diagram showing the temperature record of a carload of oranges, pre-cooled and shipped without icing under regulated ventilation, April, 1907.

to these as soon as possible after severance from the tree. Under such conditions fruit may be kept with a minimum of waste.

The charts reproduced herein show very forcibly the result of these experiments in America. From these it would seem that the methods in vogue in this State with regard to picking, packing, and transporting our fruits require thorough reorganization.

In the absence of reliable data, no opinion can be given with certainty; but it would appear that the blame for the loss which occurs each season during transit to the United Kingdom and Europe, and which in the past has been mostly laid at the door of the shipping companies, is due, not only to improper attention to temperatures during transit, but is largely the result of the non-application of proper methods before the fruit leaves the State.

The question, as to whether the expenditure which would be incurred in order to bring our present methods of handling fruits generally more up to date, may be judged from the results obtained during the past two seasons. These indicate that only 60 per cent. of all shipments arrive in anything like first-class condition, and that even in these latter it is probable there exists great room for improvement. It is stated that a large portion of our apples when marketed in Europe shows a more or less shrivelled appearance of the skin. This is most likely due to the non-application of cool-storage temperatures immediately after the fruit has been harvested, and also to the necessity which (through the absence of such cool storage facilities) at present exists for picking our fruits before full maturity has been attained.

(To be continued.)

SHELTER, SHADE, AND WINDBREAKS.

By J. R. Tovey, Herbarium Assistant.

Farmers, as a rule, do not go in for much tree planting, except perhaps a few shelter trees around their homesteads. Perhaps this arises from the cause that they think the land can be turned to more profitable account by employing it for stock-raising or crop-growing purposes. This may be true where the farmer has only a short lease of the ground, but when he is the owner it will pay him to plant. If you visit a farm on a windy day and see the sheep feeding restlessly to windward, or seeking the poor shelter of some gully, it would give you a very unfavorable opinion of the place, compared with that which you would form if the flock were contentedly grazing in a paddock sheltered by a belt of trees. Nothing is more distressing than to see horses and cattle listlessly moving round the fence-lines in search of a shady corner to protect themselves from the heat and glare of the scorching sun. In contrast, how refreshing it is to see them enjoying the cool shade of trees! Cattle, during very hot weather especially, prefer to feed in the cool of the morning or evening, and to lie in the shade and chew the cud during the heat of the day. Peace and contentment are as essential to the production of milk of the best quality as to putting on beef, and when the influences on milk and meat supply are duly appreciated, every paddock will have its clump of trees to shelter the

stock, both from the cold winds in winter and the heat in summer, thus combining landscape beauty with economy of grazing and farming for profit.

Some farmers think that the only benefit to be derived from tree planting is the future value of timber, and consider this too remote to be a sufficient inducement to incur the expense of planting on the farm, but this is a mistaken idea, for in a few years the benefit would begin to accrue and would become more pronounced year by year. The deeply penetrating roots, which most trees form over a part at least of their root system, draw up water from the deeper layers of the soil, to which the roots of most crops do not reach.

This water contains all the mineral constituents of the plant's food in varying proportions, and these salts are largely stored up in the leaves and bark as waste products after they have been utilized. In this way they again eventually reach the surface of the ground, while the fallen leaves and bark slowly rot and add to the percentage of humus in the soil, so increasing its capacity for holding water, and thereby aiding in maintaining the fertility of the soil.

The value of trees as humus-producers can hardly be exaggerated, for the benefits conferred upon the soil by the presence of humus in it are many and various. It increases the water-holding capacity of the soil. Thus a soil containing a fair quantity of humus may hold from two to three times as much water available for the plant's use as a pure sand.

The humus formed from the decaying leaves of trees is very valuable: the presence of humus increases the chemical action in the soil, and causes more of the insoluble constituents of the soil to be rendered soluble and available for mineral plant food. Humus lightens heavy soils and favours their aeration.

Not only do trees act as soil-makers, but also as soil-preservers. Thus belts of trees on the banks of streams do not only prevent the erosion of the banks, but their roots form a filter through which the drainage water must pass, and be partly deprived of its mineral matter. At the same time, the effect is to hold up the water on both sides, and prevent over-rapid and erosive drainage from the soil.

Settlers generally are too apt to consider bush land as something to be cleared, even to the last piece of scrub. It is not until the necessity arises of buying fuel for domestic use that they become aware of the fact that they could have profitably produced fuel for home consumption on the uncultivable portions of the farm practically free of cost.

Hedges.

It is better to have no hedges if proper attention cannot be given them. In some districts one finds hedges neglected, and allowed to run wild, taking up much valuable space and reducing the effective width of the field they occupy. A well-managed and properly formed hedge should not be more than 30 inches wide if the annual trimming and cleaning has been properly attended to, and a height of 6 feet is usually sufficient for ordinary purposes.

No doubt the expenditure incurred in fencing off a hedge from stock for the first few years prevents many farmers from improving

their properties by these desirable acquisitions, but such expense is amply repaid by ultimate results.

There is a great variety of opinion with regard to the kind of trees or shrubs that should be planted, and to the time and manner of planting. Every variety recommended might be entitled to preference in particular localities, but very few have a general adaptation to all parts of the State; it is therefore necessary to consider the condition of a given locality.

The ground where hedges are to be planted should be free from stagnant water, and should be trenched to a depth of 2 feet by about 3 feet in width. If the soil is poor or shallow in places, it should be removed and replaced by more fertile soil, so as to make the whole line as equal in quality as possible, and thereby secure uniformity in growth.

Hedge plants can be transplanted at any time from April to September. The distance between the plants depends on the size at planting, rate of growth, and variety grown.

SEA-COAST PLANTING.

The principal evil which one has to contend with in seaside planting is caused by the saline spray, which is carried by the wind and deposited on the leaves and branches of trees and shrubs. The effects of salt-laden winds are much more injurious to young trees that have been raised in a sheltered nursery than they are to those that have been exposed to the full blast from their earliest stages. This is, no doubt, the cause of many failures at the outset.

Before attempting the planting of moving sands, these must be prevented from invading and smothering the young plants, and care must be taken to keep the wind from carrying away or otherwise modifying the adjacent surface.

The preparation of the ground for seaside planting will necessarily depend on its nature. If the ground is heavy and sour, stagnant water must be got rid of by draining. On pure sand, as previously mentioned, the sand must be kept from drifting by planting sand-binding grasses—for instance, the Maram Grass (*Ammophila* (*Psamma*) *arundinacea*), Sand-Lyme Grass (*Elymus arenarius*), Hairy Spinifex (*Spinifex hirsutus*), Spreading Spinifex (*Spinifex paradoxus*), &c., and also the numerous varieties of Mesembryanthemum. These should be sown at least two years before tree planting, so as to have the whole well covered, not only to prevent the sand drifting, but to afford protection to the young trees.

The most satisfactory results can be obtained from trees raised in a temporary nursery near the planting site, if a comparatively sheltered spot, containing sandy soil, is available. The young seedlings thus early become inured to the prevailing salt-laden winds, and when planted out are less liable to their injurious effects. Young plants should be of such a size that they will not be bent by the wind, and yet large enough to prevent them being covered with sand. Suitable sizes are usually from 8 to 12 inches high. Dull moist weather should be chosen for planting, and care should be taken to prevent the drying of the roots.

SOME SUITABLE TREES AND SHRUBS.

Southern Country (Coastal, Plain, and Upland)

Australian.

Eucalyptus cladocalyx (*corynocalyx*), "Sugar Gum."
Eucalyptus botryoides, "Mahogany Gum."
Eucalyptus cornuta, "Yate."
Eucalyptus melliodora, "Yellow Box."
Leptospermum laevigatum, "Coast Tea Tree."
Acacia pycnantha, "Golden Wattle."
Acacia mollissima, "Late Black Wattle."
Pittosporum undulatum, "Sweet Pittosporum."

Exotic.

Pinus Halepensis, "Aleppo Pine."
Pinus Halepensis var. maritima, "Seaside Pine."
Pinus pinaster, "Cluster Pine."
Pinus insignis, "Monterey Pine."
Pinus canariensis, "Canary Island Pine."
Schinus molle, "Pepper Tree."
Cytisus proliferus, "Tagasaste."

Hill Country

Australian.

Eucalyptus amygdalina, "Narrow-leaved Peppermint."
Eucalyptus polyanthemos, "Red Box."
Eucalyptus camphora, "Sallow."
Eucalyptus obliqua, "Messmate."
Acacia melanoxylon, "Blackwood."
Angophora intermedia, "Gum Myrtle."
Pittosporum undulatum, "Sweet Pittosporum."

Exotic.

Cupressus macrocarpa, "Monterey Cypress."
Cupressus torulosa, "Nepaul Cypress."
Pinus Halepensis, "Aleppo Pine."
Pinus ponderosa, "Yellow Pine."

Mallee and Dry Northern Country

Australian.

Casuarina Luehmanni, "Buloke."
Casuarina glauca, "Grey Buloke."
Eucalyptus Behriana, "Bull Mallee."
Eucalyptus bicolor, "Black Box."
Eucalyptus cladocalyx (*corynocalyx*), "Sugar Gum."
Eucalyptus leucoxylon, "Yellow Gum."
Eucalyptus sideroxylon, "Red Ironbark."
Grevillea robusta, "Silky Oak."
Acacia elata, "Cedar Wattle."

Exotic.

Cupressus macrocarpa, "Monterey Cypress."
Pinus Halepensis, "Aleppo Pine."
Pinus insignis, "Monterey Pine."
Robinia pseudacacia, "False Acacia or Locust Tree."
Schinus molle, "Pepper Tree."
Cytisus proliferus, "Tagasaste."

The foregoing list does not by any means exhaust the number of varieties suitable for any given locality.

Additional information regarding tree planting can be gleaned from the following papers:—

"Tree Planting and Forest Preservation," *Journal of Agriculture*, April, 1907.

"Victorian Tree Planting Competition, 1912-15." *Journal of Agriculture*, November, 1911.

FARM SANITATION.

By C. H. Wright, Instructor in Plumbing, Swinburne Technical College, Hawthorn.

Part I.—Septic Tanks and Sewerage Connexions.

It has been said that a nation's first line of defence is sanitation. The statistics of this State show that a weakness exists in that line, which can be traced to country districts, but the farmer who is handy with tools can do much to strengthen that line of defence, and, at the same time, lighten the burden of domestic drudgery for his women folk. It is not recommended that the farmer should attempt to erect septic tanks and their connexions. But there is no reason why he should not understand the action of such tanks and the use of the

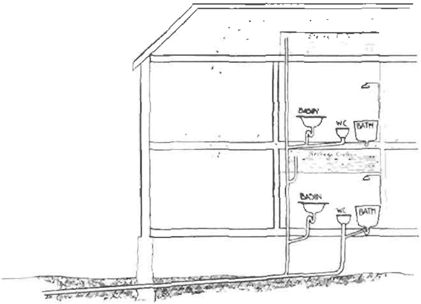


Fig. 1.—Examples of faulty construction showing how overflow pipes conveyed sewer gas into a house.

various pipes and fittings. Such a knowledge should be of value in enabling him to better select with whom to place the work.

In order to better explain the risks run, and what should be avoided, the following, Figs. 1 to 5, drawn from actual cases, will illustrate that care and good judgment are necessary when septic tanks are to be installed.

Fig. 1 shows how on one farm the discharge of sewage from water closets, &c., into a river was arranged — how the storage cisterns situated in bathrooms, and also under living rooms, overflowed into pipes that joined the main sewer, and how that pipe acted as a conduit for conveying sewer gas to the cistern water, contaminating it, and also discharged sewer gas under the floors of the surrounding rooms.

Fig. 2 illustrates an instance where two water closets discharged their content into a cesspit in a garden. Waste pipes from two bathroom floors were so arranged that they acted as vent pipes, and conveyed the sewer gas directly into the bathroom, while leaking joints

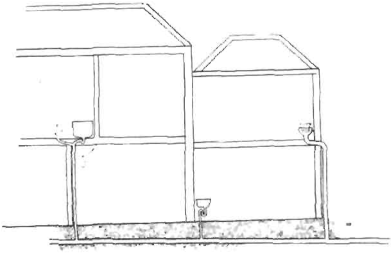


Fig. 2. Bad planning leaky joints allowed sewer gas to escape into a children's playroom causing serious outbreak of sickness.

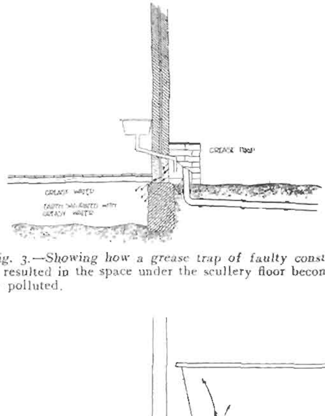


Fig. 3.—Showing how a grease trap of faulty construction resulted in the space under the scullery floor becoming very polluted.

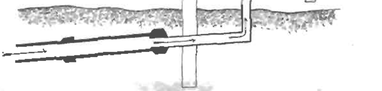


Fig. 4.—A waste pipe connected as above will convey

in the bath waste pipes which ran up the wall of the room below, allowed sewer gas to *escape into the children's nursery* in such quantities that *a serious outbreak* of sickness occurred, and necessitated *a thorough* overhaul of the sanitary arrangements.

Fig. 3 shows a sink waste discharging into a brick receptacle for catching the grease. An inspection revealed the fact that the greasy water had been leaking through the joints, then through the foundations, until the space under the floor of the scullery —12 feet square— was thoroughly saturated with greasy water: this had soaked to a depth of 2 feet in the soil below.

Many cases similar to the above could be quoted, and emphasize the value of correct planning and the employment of able workmen.

The education of the people increases the demand for sanitary fittings, and a consequent

naturally follows. Thus bath, lavatory basins, water closets, sinks, and fittings that were at one time a luxury only to be enjoyed by the rich, are now brought within the reach of all.

Waste Pipes.

Regular water is the term applied to water more or less fouled from baths, sinks, closets and other house fittings. This is the liquid that is generally conveyed into a septic tank.

Water used in connexion with our daily life generally enters our dwellings in a pure state. It passes out fouled in various degrees. That which passes through the body acquires faecal and other solids, and, in course of sickness, germs. That used for the body acquires dirt and more or less soap. The kitchen water contains grease and vegetable matter, the laundry water dirt and soap, and all these must be conveyed away from the house as quickly as possible. The odors, too, must be prevented from entering the house: this is done by means of traps, and in modern work the bad air is discharged high up by means of vent pipes.

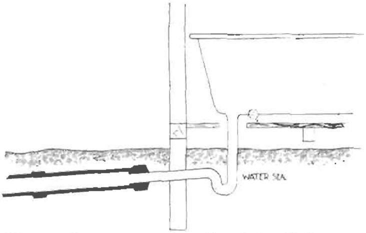


Fig. 5.—Even with a trap as above it is still insecure.

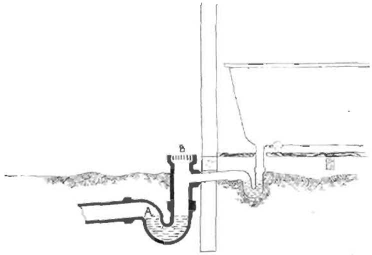


Fig. 6.—Showing the correct method. The waste pipe is both trapped and disconnected.

How water from sinks, baths, &c., should enter a septic tank drain.

If the bath, basin, or sink is connected as shown in Fig. 4, the waste pipe will convey bad air into the house.

If the waste pipe has a trap containing a water seal, as shown in Fig. 5, it is still insecure, because if the trap loses its water seal, the bad air will still enter the room.

Fig. 6 is the correct way. It shows the waste pipe both trapped and disconnected from the drain.

The value of this method is clear. Supposing the trap A should lose its seal, the bad air from drain will escape readily at B.

Wrought iron pipes and brass traps should be used under floors as lead is liable to be perforated by rats and receive other damage.

Fig. 7 shows three waste pipes discharging into a gully trap: all are disconnected from the drain. The two pipes on the right-hand side are from a sink and a set of troughs. When these are together, as shown in Fig. 8, there is a great temptation to run all wastes into the one pipe. That must not be done unless the waste pipe is vented. Have them run as shown in Fig. 8.

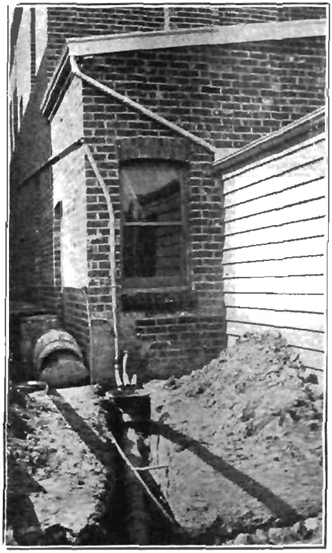


Fig. 7.—Another method of disconnecting waste pipes.

When waste pipes from *two or more fittings* are connected to one pipe, the discharging of water from one fitting is likely to syphon out the water seal from the traps under the other fittings.

Suppose fittings were connected as shown in Fig. 9. When the water from bath A is discharged, the *traps under basin B and* sink C would lose their seal.

If waste pipes are arranged as in Fig 10, the traps keep their seal, and there will always be a circulation of fresh air through the pipes obtained through the foot ventilation provided by disconnecting the waste from the drain.

The sink on the ground floor is connected separately to save the trouble of venting.

Fittings.

There are various types of stoneware fittings made suitable for receiving the discharging end of waste pipes, and also providing foot ventilation. *These will be referred to later.*

Gratings in sinks, baths, basins, and troughs should have sufficient space area between the bars to equal, or more than equal, the sectional area of the waste pipes.

When water is discharged from the fitting, it should run through the waste pipe like a plug; it will then keep the pipe clean. But if the grating is too small, the water only partly washes the sides, consequently a gradual accumulation of offensive matter collects.

Traps should be placed as near the fitting as possible. All traps should have a water seal of 2½ inches.

There are two kinds of material used for waste pipes. Drawn lead pipe and galvanized wrought iron pipe.

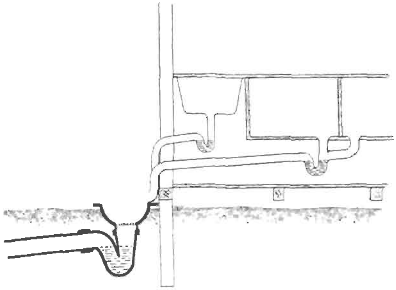


Fig. 8.—Showing how waste pipe should be run separately into the disconnecting trap.

Each have their advantages and disadvantages. Lead is smooth inside, while iron is somewhat rough. Lead is liable to sag if not suspended, while galvanized iron is self-supporting. Lead is less

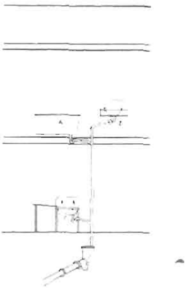


Fig. 9.—If waste pipes from inside fittings run into one pipe like this the traps will lose their seal, and sewer gas may enter the house.

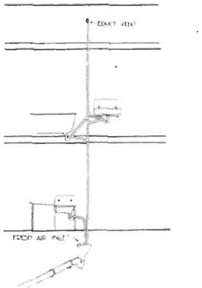


Fig. 10.—This shows the correct way vent pipes prevent syphonage of traps, and fresh air is always circulating through the waste pipes.

easily acted upon by chemicals than iron. Lead can be worked and bent to suit any position, while iron has to be cut and screwed and fittings used. However, both have their use in waste pipe work, and *the advantages of both should be availed of.*

Whatever material is used, sufficient cleansing screws should be provided so as to make it easy to clean a waste pipe. In lead piping, these can be inserted by the plumber making a hole in the pipe and soldering the joint.

For iron pipe work, fittings such as bends, branches, &c., can be obtained with cleansing screws included.

All branches should be curved, and right angle junctions avoided.

Fig. 11 shows how branches should be designed in iron and in lead pipes.

The size of a waste pipe must not be too small, or it will become stopped up. The sizes should be:—From a sink or wash trough, 2 inches; bath, $1\frac{1}{2}$ inches or 2 inches; wash basin, $1\frac{1}{2}$ inches.

The essential points in waste-pipe work are these:—

See that waste pipes are disconnected from the drain, providing a fresh air inlet.

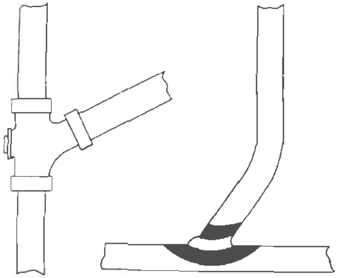


Fig. 11.—All branches in iron or lead pipes should be curved, and right angle junctions avoided.

See that all fittings are trapped; that the traps are fixed close to the fitting; that the wastes are vented so as prevent syphonage of the traps. See that sufficient cleansing screws are provided, and that all joints are free from leaks.

Occasional water, that is, water from the overflow of cisterns, bathroom floor wastes, &c., should not be connected to the drain in any way, as in Fig. 2, but should discharge direct into the open air.

The overflow of cisterns and waste from trays under fittings carried through the walls to the open air give notice when anything is wrong inside.

Baths, lavatories, sink and trough wastes should be disconnected from the drain.

Water closets and slop sinks should be directly connected with the drain.

Kitchen sinks and wastes with a heavy grease discharge should pass through a grease interceptor before reaching the drain.

(To be continued.)

GENERAL NOTES.

CALF FEEDING—

Agricultural experiments vary in the value of their results. In some the value is low, owing to insufficient care being taken to eliminate possible sources of error. This often applies very particularly to feeding experiments where working with only a few animals; the superiority of the best ration may be entirely discounted by the inferior feeding or assimilative faculty of the animals receiving the feed. Some calf-rearing experiments recently conducted at Woburn for the Royal Agricultural Society of England, and reported in the *Agricultural Gazette,* illustrate the case in point. The findings may be right, but they may not—the results are inconclusive. Twenty calves were purchased in the open market when two to three days old, and were fed alike for three weeks on whole milk only. The calves were then divided into five lots of four each, and fed differently for the next nine weeks. One lot continued to receive whole milk, in the other four lots the whole milk was gradually replaced by separated milk, which was supplemented by various milk substitutes. When three months old (at the termination of the nine weeks) the calves weighed as follows:—

	Average Gain per Calf per Week lbs.
1. Crushed oats	13.30
2. Whole milk	12.83
3. Cod liver oil	9.66
4. *Patent calf meal* .. .	8.66
5. Linseed and oatmeal gruel ..	8.29

The crushed oats were given dry, starting with a handful at a time; the other foods were mixed with the separated milk. After this weighing the calves were turned out to pasture for three months, and were treated alike, receiving also a little linseed and crushed oats with hay. At the end of this period they were again weighed to find the increase for the second three months.

	Average Gain per Head per Day lbs.
1. Crushed oat lot	2.19
2. Whole milk lot	2.00
3. Cod liver oil lot	1.90
4. Patent calf meal lot	1.75
5. Mixed gruel lot	1.57

The lots stand in the same order as when they received different feeds during nine weeks of the first period. In these circumstances it is difficult to say how far the results of the early feeding were not due to the character of the calves. A feeding experiment, to be conclusive, must use a larger number of animals. The only reliable conclusion from these tests is that dry crushed oats can be used with good results to young calves along with separated milk. That it is the best food of those tested has not been proved.

Lack of green food is apt to lower the yield and quality of milk. Silage is useful here.

AN AGRICULTURAL COLLEGE TRAIN—

In California the mountain is carried to Mahomet, and the farmers are served by a travelling college. This is a train. The season 1911-12 was the fourth year of running, and close on 5,000 miles were covered in the last campaign. In the train individual cars were devoted to special subjects of agricultural or horticultural interest, so that persons interested in a special line could visit that car in particular, listen to the lecture of the specialist in charge of the car, and ask as many questions as they saw fit. The precise number of auditors at these lectures during 1911-12 was 102,624, according to a careful census taken at each stop of the train. This was an increase of 24,000 persons, or 31 per cent. over the attendance of the previous year. Commenting on the latest tour, the *Pacific Free Press* states that there was a noted increase of interest at practically every place visited, and in all of the few instances where the attendance diminished the result was due to inclement weather. The train appears to be doing good work.

PROTEINS IN ANIMAL NUTRITION—

Carbohydrates and fat cannot for long sustain an animal in life, because it must also receive nitrogenous nutrients. The chief nitrogenous nutrients in any fodder or ration are the proteins (albuminoids). Proteins however are of different kinds, and the proteins of one plant and in a minor degree of one part of a plant, differ from the proteins found in other plants or in animals. During the last half-century it has been customary to assume that the need for nitrogenous nutrients by the animal could be made good by any protein, regardless of its origin, provided only that it was capable of digestion. Recent investigations controvert this view. It now appears that the various proteins have a specific value in nutrition, this value in each case depending upon the kind of cleavage bodies, or animo-acids, into which it is broken up on hydrolysis. In the *Zeitsch. Physiol. Chem.* 77 (1912) it is stated that an animal can be sustained exclusively on the cleavage products of suitable proteins, and that a protein which contains amino acids in a proportion unlike that found in the body tissues, is not so well utilized as one which yields them in the quantities in which they are found in cell protein. As would be expected from this, most plant proteins are less well utilized than those of animal origin, and to get to the root of the matter it is necessary for the chemist to know something of the amino acids contained in the proteins of different feeding stuffs. For the farmer it is generally beneficial to use mixed grains or fodders, because the proteins of the several ingredients yield bodies which are complementary to each other in the animal economy.

With foods the mere fact of change generally stimulates milk-production, but unless the change is to a really better class of food the improvement will be short-lived.

BUNYIP MILKING COMPETITIONS.

By P. J. Carroll.

The following are the particulars of tests carried out at the Government Cool Stores of cows entered for competition at the Bunyip Agricultural Society's recent Show. The results represent 24 hours' production, and may be taken as representative yields of the cows competing:—

Test No.	Lbs. Milk.	% Fat.	Butter Fat.	Total Fat.
1 N . .	15½	4·8	·744	1·569 lbs.
1 M . .	16½	5·0	·825	
2 N . .	17½	5·8	1·015	1·840 ..
2 M . .	16½	5·0	·825	
3 N . .	17½	4·2	·735	1·279 ..
3 M . .	17	3·2	·544	
4 N . .	16	5·2	·832	1·504 ..
4 M . .	16	4·2	·672	
5 N . .	19¼	3·8	·731	1·352 ..
5 M . .	18¼	3·4	·621	
6 N . .	23½	5·7	1·347	2·257 ..
6 M . .	26	3·5	·910	
8 N . .	20	4·4	·880	1·285 ..
8 M . .	11¼	3·6	·405	
9 N . .	20	4·0	·800	1·590 ..
9 M . .	25½	3·1	·790	
10 N . .	15½	5·6	·868	1·811 ..
10 M . .	20½	4·6	·943	
11 N . .	28¼	4·3	1·215	2·167 ..
11 M . .	25¾	3·7	·952	
12 N . .	19½	4·0	·780	1·502 ..
12 M . .	19	3·8	·722	

From the above table the following deductions may prove of interest to dairymen:—The average yield of fat of the 11 competing cows was 1.65 lbs. per day, equal to 11.55 lbs. per week; or for an average month 50.325, worth at 1s. per lb. £2 10s. 3d. per cow per month. This is a very good average result; yet there is nothing to prevent the farmer attaining such a standard with his dairy herd. At the present time it is safe to say that it is not reached by many dairy herds in the State. Good as the average is, an analysis of the figures will show the possibility of still further improvement.

The best cow (No. 6) produced 2.257 lbs. of fat in 24 hours, equivalent to 15.8 lbs. per week, or 68.83 lbs. of fat per month, worth at 1s. per lb. £3 8s. 9d.

The three best cows (Nos. 6, 11, 2) yielded an average of 6.264 lbs. of fat per day, 43.848 per week, or equivalent to 191 lbs. of fat for the month, worth £9 11s.; or an average of £3 3s. 8d. per cow.

The production of the three worst cows (Nos. 5, 8, and 3) was 3.91 lbs. of fat per day, 27.41 per week, or 119.43 lbs. for the month, valued at £5 19s. 6d.; or an average of £1 19s. 10d. per cow.

The worst cow (No. 3) produced 1.279 lbs. of fat in a day, 8.953 in a week, or 39 in the month, worth at the same value as the others £1 19s.

Assuming that a dairyman had a herd of 20 cows equal to the best cow, his gross return for cream for the month would amount to £68 15s. sterling; if in accordance with the three best cows, the value of the month's production would be £63 13s. 4d. The average for a similar herd of the three worst cows would be £39 16s. 8d.; or, if the worst cow be taken, the farmer would receive from his herd £39 sterling, or £24 less than the estimated return from the best cows.

The striking feature of these comparisons is that the farmer who was fortunate enough to have a herd similar to the best cow would receive £29 15s. larger return for the month than the owner of the herd of a character in accordance with the lowest on the scale, or, to put it in another way, assuming the same amount of labour, the same quantity of food, and possibly the same amount of capital would be required to produce the return from either herd, although the receipts from one would be 75 per cent. more than from the other.

To still further extend the comparison, it would take nearly 22 of the three best cows to equal a herd of 20 like the best cow, 34 of the three worst, and 35 like the worst cow, to equal 20 of the best cows.

As a matter of fact, the average from the worst cow is not by any means a poor return, and many dairymen would be glad to have a herd giving such a return; but the comparison tends to show the enormous room there is for improvement, and demonstrates the great economic advantages that would accrue to dairymen by systematically culling, and breeding only with bulls of noted butter-producing strains.

The mere fact of breeding and culling, however, is not sufficient. Feeding is essential for the economical production of butter fat, and there is, indeed, ample room for improvement in this direction; and efforts to improve the production of our herds in the manner indicated must be preceded by, or carried on simultaneously with, greater attention to the production of fodder.

ESTIMATING HAY YIELDS—

It is a custom with some farmers when cutting hay to keep account of the balls of twine used. By this means they check their estimate of the probable yield. At the Roseworthy College this method of judging yields has been tested by weighing each load of hay as it went to the stack, and the results are given in the South Australian *Journal of Agriculture*. In 1911 the yields worked out at 2 tons 6½ cwt. per ball of binder twine. In 1912 the tests were repeated separately on half-a-dozen good-sized paddocks, and the figures ranged from 1 ton 15¼ cwt. up to 2 tons 9¾ cwt., according to the height of the straw and the freedom from under-growth. The reasons for these variations will be readily understood. For the season, the general average at Roseworthy worked out at 2 tons 0½ cwt. on 237 acres of crop. It is noted that many farmers calculate on 2 tons as a fair average figure, taking one season with another; but that where the hay is tall and well-grown, and tolerably free from weeds and under-growth, an estimate of 2½ tons per ball of twine will come nearer to the truth.

THE USE OF PHOSPHATES IN VICTORIAN AGRICULTURE.*

(*Continued from page 165.*)

By John W. Paterson, B.Sc., Ph.D., Experimentalist, and P. R. Scott Chemist for Agriculture.

Attention has been drawn to the low percentage of phosphoric acid in Victorian soils as extracted by strong mineral acids. As in cropping, the total acid is of importance only in so far as it is capable of yielding available phosphoric acid, the particular form of combination in the soil ought at first sight to determine its immediate value. The principal soil phosphates are those of calcium, aluminium, and iron. As tri-calcium (lime) phosphate dissolves—if somewhat slowly—in dilute acids, while the phosphates of iron and aluminium are practically insoluble, Dyer's solvent (1 per cent. citric acid) should throw some light upon the form of combination in which the phosphoric acid exists in soils.

A considerable number of soil analyses have been made in the laboratory of the Department of Agriculture by Dyer's method, and the following table shows the results for three groups. Dyer estimates that less than ten parts of phosphoric acid extracted by 1 per cent. citric acid shows the soil to stand in immediate need of phosphatic manuring:—

AVAILABLE AND TOTAL PHOSPHORIC ACID PER 100,000 DRY SOIL.

District.	Available Phosphoric Acid.	Total Phosphoric Acid.	Percentage of available in Total.
Wimmera (14 soils)	7·8	52	15·
Mallee (6 soils)	4·5	50	9
Goulburn Valley (4 soils)	3·6	68	5·3
Hall's English soils (10 soils)	19·17	98	19·6

Of the Victorian soils here mentioned, the Goulburn Valley group alone are deficient in carbonate of lime, and here the percentage of availability is lowest. We do not, however, attempt to trace a definite connexion here with the lime factor; suffice it to point out that, in the soils examined, the available phosphoric acid is decidedly below the 10 parts minimum set by Dyer, and that not only is the total phosphoric acid, as previously pointed out, low, but this phosphoric acid has a lower percentage of availability than is found in English types.

It will be agreed that the availability test for phosphoric acid has certain uses, but that it is also at times a quite unreliable guide as to the practical needs of a soil. Personally, we can only regard it as giving general indications. As a guide it often breaks away. Examples may be quoted at random. Thus, in some of the Departmental oat experiments, one soil showing only 3.4 parts available phosphoric acid gave no increase with 1 cwt. super.; one with 15 parts gave 1,836 lbs. increase with 2 cwt.; and one with 20 parts "available" phosphoric acid gave 2,307 lbs. increase with 3 cwt.

* Address delivered at the Melbourne meeting (1913) of the Australasian Association for the Advancement of Science.

super. Similarly, in America, Wheeler* found that from three different soils $\frac{N}{5}$ nitric acid extracted 14, 16, and 14 parts of phosphoric acid, but the corresponding turnip yields were 22, 8, and 2 tons. Hydrochloric acid of the same strength gave similar results. Equally unsatisfactory results were obtained with $\frac{N}{100}$ ammonium hydroxide.

The discrepancies which invariably occur when one endeavours to connect a number of analyses of available phosphoric acid with the cropping efficiency of the same soils seem to indicate that the method of phosphoric acid absorption by plants is very imperfectly understood. It is no simple case of solution by acids and osmosis through the plant root. Were it so the availability test would be theoretically perfect. Soil acidity seems to help the solution of insoluble phosphates in one way, and hamper it in another. The effect depends, apparently, upon which particular phosphate predominates—whether lime phosphate, or iron and alumina phosphates within the soil.

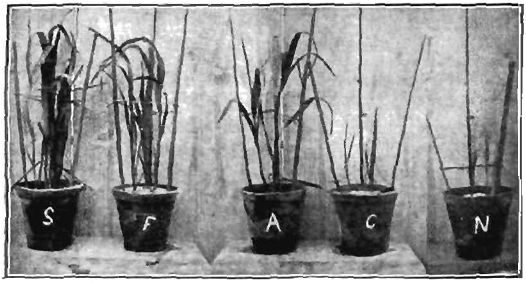


FIG. 3.—RESULTS OF POT EXPERIMENTS AT ROTHAMSTED.

S denotes superphosphate and N no phosphate.

A great deal of work has been done in different countries upon the action of different phosphates upon crops. A simple experiment recently conducted at Rothamsted† seems to carry a deeper meaning than has been read from it. Oats, peas, and swedes were grown in pots containing chiefly pure white sand extracted, with concentrated hydrochloric washed, dried, and ignited. Three per cent. of pure carbonate of lime and .5 per cent. of ferric hydrate were added, and a nutrient solution containing all the essentials except phosphoric acid was used. To one series of pots there was added freshly-prepared aluminium phosphate; a second series got ferric phosphate; and a third got tri-calcium phosphate prepared by precipitating tri-sodium phosphate with calcium chloride. The results were as follows:—On the aluminium phosphate, oats did well throughout, and were a good colour; peas did well, but pods not very numerous, and late; and swedes did well from the start. Ferric phosphate gave very similar results to the aluminium salt with each crop. The calcium phosphate

* *Eighteenth Ann. Rep. Rhode Island Agric. Exp. Sta.* † *Jour. Ag. Sci.*, Jan., 1912.

however, failed with oats, and was no better than the no-phosphate series set up for control; peas were poorly developed, made few pods, and ripened early; swedes were late in starting, but did well ultimately. In another set of experiments, leaving out aluminium phosphate, and where the crops were weighed, calcium phosphate was about equal to ferric phosphate with peas and swedes, but markedly poorer with the oat crop.

Two deductions are made from the results. One is that the availability of a particular phosphate is dependent upon the kind of crop. This is obviously true. The other is that insoluble calcium phosphate is markedly less effective in the growth of oats than is insoluble iron phosphate. This statement is too general. Had the soil received a minimum amount of carbonate of lime, the results would almost surely have gone the other way.

The superiority of iron and aluminium phosphates in these limed soils to freshly precipitated calcium phosphate renders it improbable that the solution of any of the phosphates was accomplished by the physical action of acid solvents. There appears to be some virtue in phosphoric acid which is able to change into new combinations at the plant roots, as would be the case of the iron and aluminium phosphates in these experiments, but not of the lime phosphate. Doubtless the formation of insoluble ferric or aluminium hydrate would be a chemical motive for the change from iron to lime phosphate in a weakly acid medium, but it is difficult to see why this change, if it occurred here, should give an advantage to the new lime phosphate formed from the iron salt over the ready formed lime phosphate given as manure, unless the change were helped either by a physiological action of the root hairs or by bacteria living in symbiosis with the plant. If, as seems likely from the results, the mere fact of changing bases helps the assimilation of phosphoric acid, the inference is that either the plant itself or something helping the plant is at work in bringing the change about.

In an acid soil the orthodox view of solution of phosphate and osmosis by the root hairs can explain the results, but in a soil which is liberally supplied with lime carbonate, as in the Rothamsted experiments, a physiological rather than a physical explanation of absorption appears necessary. The same is true with regard to the not inconsiderable quantity of phosphoric acid always present in the humic matters of ordinary soils.

The fact that certain phosphates are better absorbed by some crops than by others sugests a physiological explanation of solution in cases where the soil is neutral or alkaline. No differences in the relative acidity developed at living roots are sufficient to show why one crop should starve while another does well on the same phosphate. As Wheeler states,* "the great difference in the ability of individual plants to utilize the several phosphates under varying conditions is not properly appreciated." On acid soils, or with plants grown in water cultures, the physiological assimilation of phosphoric acid may lapse in favour of the purely physical process. It is for this reason that in agricultural experiments one phosphate is best on one soil

* *Jour. Ind. & Engin. Chem.*, Ap., 1910.

and another on another. Generally speaking, there is no "best" phosphate, because the effect will always depend upon the conditions of the soil as well as on the crop grown.

In the districts of this State which are poorly supplied with lime it may be assumed that the greater portion of the phosphoric acid is in union with iron and alumina. The Chemical Department of the Wisconsin Station, in America, submitted twelve soils to extraction with dilute acid and alkali respectively, and from preliminary tests on native minerals they calculated the ratio of phosphoric acid in union with iron or alumina to phosphoric acid in union with lime.* Six of the soils were acid, and six were well supplied with carbonate of lime. In the results obtained in this way it was found that in the acid soils the ratio of iron and aluminium phosphates to lime phosphate was as 3 to 1; in the non-acid soils it was nearly 1½ to 1. The low percentage of availability of the phosphoric acid in Victorian soils when extracted with citric acid has been referred to. In such cases a high ratio of insoluble iron to lime phosphate may be depended on.

Where soils are deficient in lime, therefore, an application of this substance may be depended on to increase the availability of the phosphoric acid. The effect of lime upon insoluble iron and aluminium phosphates added as manure at Rothamsted has been referred to. Where phosphatic manure of any kind lies in the soil for some years it will largely revert to the iron and aluminium combinations. If land is limed, apparently the crop can largely recover this by absorption when it is wanted. Wheeler† gives the results of liming upon various crops at Rhode Island on plots which had each received 82 lbs. of phosphoric acid in various manures per acre up till 1902, and then no further application of phosphates. Nitrogen and potash have subsequently been given each year. Lime was applied in 1903 at the rate of 1 ton slaked lime per acre. In 1909, seven years after the phosphate applications ceased, the following yields of potatoes were obtained from the different manures:—

Residual Effect of Phosphates on Potatoes.

Seventh Crop.	Dissolved Bone Black.	Dissolved Bone.	Super.	Steamed Bone.	Thomas Phosphate.	Ground Rock Phosphate.	Raw Iron and Al. Phosphate.	Roasted Iron and Al. Phosphate.	No Phosphate.	Double Super.
With lime (1903) ..	680	676	554	630	592	505	347	594	405	607
Without lime ..	450	529	519	556	580	510	244	224	145	333
Increase due to lime	230	147	35	74	12	− 5	103	370	260	274

Liming produced its maximum effect with the roasted iron and aluminium phosphates and the no-manure plot, where presumably the native phosphates were chiefly of iron and aluminium. It had also a good effect with the raw iron phosphate, but with the ground rock (lime) phosphate and Thomas phosphate it had no effect. Viewing the results generally, it is seen that, without lime, calcium phosphates

* *Research Bulletin No. 2.* † *Loc. cit.*

were much the best, but with lime added the more refractory phosphates and also the no-manure plot made up much of their leeway.

The effect of lime in liberating insoluble soil phosphates is well seen in some experiments which we conducted last season at Burnley. The soil was obtained from Richmond Park, and was a dark volcanic loam. It was mixed with half its weight of fresh-water sand. The experiments were conducted in pots, in order to compare the manurial effect of certain materials with their unit values. Wheat was grown, and each pot, holding 45 lbs. soil, received .15 gram phosphoric acid along with .5 gram of nitrogen (dried blood) and .5 gram potash as sulphate). The results are the average of duplicates, which agreed with tolerable accuracy:—

FIG. 4.—BURNLEY EXPERIMENTS.—SHOWING HOW LIME SPECIALLY HELPS THE PHOSPHATES OF IRON AND ALUMINA.—THE YOUNG CROPS.

EFFECT OF LIME ON INSOLUBLE PHOSPHATES.

Phosphate added as—	Without Lime.	With Lime.
	grams.	grams.
No phosphate	56·16	73·37
Total in superphosphate	72·89	73·66
Water insoluble in super.	62·27	68·53
Citrate insoluble in super.	58·05	73·23
Bone meal (coarse)	59·25	72·00
Bone meal (fine)	65·88	72·25

It is apparent that while without lime each phosphate gave an increase, still the addition of lime seemed to act upon all the pots, including the no-manure pots, so that the differences were levelled up. That occurred for this particular soil after sifting and carefully mixing with the lime. It is not to be expected—and, indeed, the idea must be guarded against—that on average soils with lime applied broadcast on the surface the lime could replace phosphates in practice. The results, however, show the tendency of lime to liberate phosphoric acid from insoluble soil phosphates, and harmonize in direction with Wheeler's field experiments at Rhode Island.

Other experiments which we conducted at Burnley show that lime has a special effect upon iron and aluminium phosphates, and little or no effect upon calcium (lime) phosphate. A native (South Australian) calcium phosphate was tested against aluminium phosphate (wavellite) and iron phosphate (vivianite). The accompanying photographs show that, without lime added, calcium phosphate (pot 5) gave a better yield than either the aluminium phosphate (pot 6) or

the iron phosphate (pot 7). When lime was used along with these phosphates, however, the aluminium phosphate (pot 26) was superior to the calcium phosphate (pot 25), and the iron phosphate (pot 27) was also greatly improved in its action by adding lime. The differences, as the earlier photograph shows, were strongly apparent in the young plants, showing that phosphoric acid is specially required by plants in the first stages of development.

In an earlier part of this paper it was noticed that dissolved phosphate was the principal source of supply to the Victorian farmer. Generally speaking, and looking to the low humus content of our soils, it is likely to remain his best source for many years to come. In many cases he would get a better return from his phosphates, particularly during the years of grazing, by applying small quantities of lime, but not along with the phosphates. Lime in dry districts should

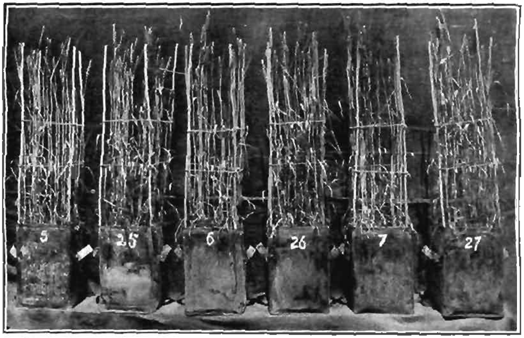


FIG. 5.—BURNLEY EXPERIMENTS.—THE CROPS OF FIG. 4 WHEN MATURE.

be used in small doses, as it probably increases liability to drought. But the cumulative effect will be good.

Victoria, unfortunately, has not disclosed so far workable deposits of calcium rock phosphate, but it has fairly extensive deposits of wavellite (phosphate of alumina). The experiments of Wheeler, and the benefits of lime upon these insoluble phosphates (which could be corroborated from numerous sources did time permit), point to the conclusion that wavellite burned with limestone, and ground, might make a useful fertilizer. We hope that the sundry points touched upon will at all events draw attention to the extreme importance of studying the phosphate supply of local soils. Much of the comparative infertility of the grazing land is due to deficiency of available phosphates. In conclusion, we repeat the suggestion previously made, that systematic investigation as to the best means of applying phosphates to cereals should be undertaken before the most profitable quantity for ordinary farm practice can be finally decided.

CITRUS CULTURE IN VICTORIA.

(*Continued from page 150.*)

By S. A. Cock, Orchard Supervisor, Bendigo.

PART II.—VARIETIES.

The Citrus family includes the Orange, Lemon, Citron, Lime, Shaddock, Pomelo, and Bergamot. It is a genus of plants belonging to the natural order (Aurantiaceæ), and consists of trees and shrubs, which are probably natives of India and other warm parts of Asia, many of which are now cultivated in all warm and temperate countries on account of their fruit. The wild state of the Orange is not definitely known, although its character may be fairly confidently inferred from the degeneration of cultivated varieties. Its tendency to degenerate is remarkable, and very few seedling Oranges are of any commercial value. Hence there are many types, such as—

Seedlings, raised indiscriminately from seed.

Modified seedlings, raised by natural cross pollination.

Hybrids, raised by a crossing of two forms differing in character.

Citrus Aurantium (Linné).

The Orange in its widest application. General characteristics: Tree, evergreen; size, moderate; branches, with spines; leaves, compound; petiole, winged; point of union marked by articulation; fruit, pulpy; rind, spongy; oil cysts of rind, concave and convex.

Varieties.

Citrus bigaradia (Duhamel).

The Sour Orange. Characteristics: Branches, very spiny; petiole, winged; flowers, large and highly perfumed; staminate (male organs) and pistillate (female organs) qualities strongly developed; fruit, sour and acid; rind, bitter; oil cysts of rind concave; tree of medium growth, extremely hardy, and on this account largely used for purposes of stock. From this species (*Bigaradia or Vulgaris*) all other varieties are supposed to have sprung.

Type.—Common Seville. Plate 5. Fruit, large, flattened at blossom and stem ends; rind, deep orange, rough, thick; flesh, juicy, yellow, sour acid; seeds, numerous; divisions, regular; rag, very loose in centre. Use: Fruit, marmalade; flowers, Neroli oil.

Citrus bergamium (Risso).

The Bitter Orange.—Tree, small to medium; branches, spiny; leaves, elongated; flowers, small, white, and highly perfumed; rind, oil cysts concave.

Type.—Sweet Seville. Plate 6. Fruit, small to medium, flattened; rind, light orange, smooth and thick; flesh, bitter; divisions, regular; rag, very open in centre. Use:-Marmalade, and Oil of Bergamot from the rind.

Note.—On page 149 (Plate 4) plan of irrigation block, scale should read 20 chains to 3 inches.

Citrus decumana (Linné).

The Shaddock.—Tree, quick grower and large; leaves, large; petiole, largely winged; fruit, pear-shaped and of exceptionally large size; flesh, greenish and bitter acid; seeds, large; skin, thick, pale yellow, and very rough. Use: The Shaddock is worthless commercially, but the tree itself is very ornamental, and its large fruit, of which the Forbidden Fruit is a variety, is used only as a novelty, or for decorative purposes.

Citrus pomelanus (Willd).

The Pomelo.—Tree, rapid grower; leaves, large; petiole, winged; flowers, large and white; fruit, round or pear-shaped; rind, fairly thin, smooth, pale yellow; flesh, pale yellow, with agreeable flavour.

Types.—Triumph Pomelo. Plate 5. Fruit, large, slightly pear-shaped, firm, and heavy; rind, pale yellow, very smooth, fairly thin; flesh, firm, fine, delicately bitter, and slightly acid; seeds, numerous; divisions, fairly regular; rag, loose in centre. Use: Marmalade.

March Seedless.—The grape fruit of America. The following description was given to me by W. J. Stover, Esq., of Shepparton, who came to Victoria with the American irrigation visitors:—

Origin, Florida.

Type of tree, very strong grower, heavy and sure bearer; fruit, hangs in clusters, hidden in the foliage; period of ripening, lengthy; type of fruit, larger than Navel Orange, and pear-shaped; skin, pale yellow, fairly thin; flesh, very fine, and deliciously agreeable. Ranks equal with Navel Orange in value as regards prices obtained for Navels in America, and is now being largely planted in California for home use and export, and is very largely used in the United States as breakfast dessert, for which purpose it ranks equal to pineapple.

Citrus trifoliata (Linné).

A deciduous Japanese species, of dwarf habit, used for stock in very wet situations and heavy soils. Results in this State unsatisfactory.

Citrus Japonica (Thunberg).

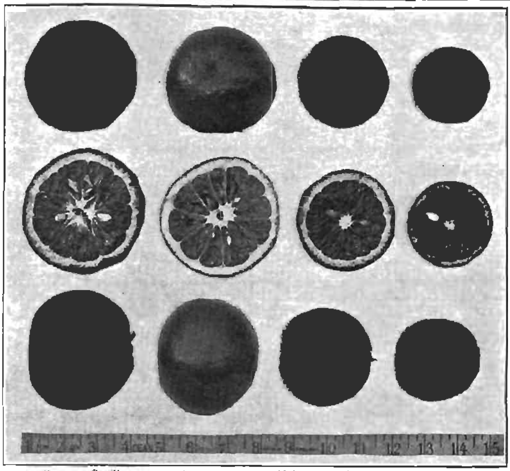
The Kumquat.—A shrubby tree of dwarf habit, with fruit the size of a large grape; rind, sweet; flesh, acid; makes an excellent preserve, preserved whole.

Types.—Round Kumquat, Oval Kumquat, Flat Kumquat.

Citrus Nobilis (Loureiro).

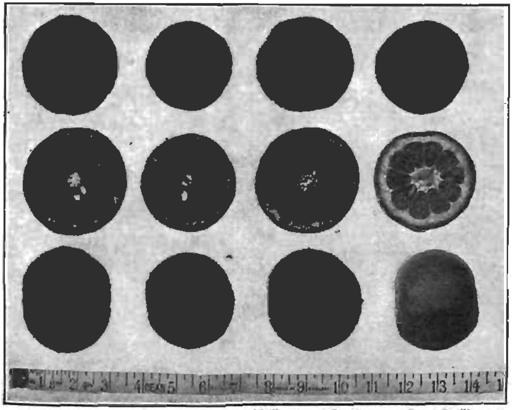
The Mandarin Orange; tree, small to medium; leaves, small, and very narrow; petiole, slightly winged; flowers, white; fruit, generally small and flattened; skin, thin and easily detached from the flesh.

Types.—Dancy Tangierine, Plate 7; fruit, medium, very flattened and depressed; rind, deep orange red, very thin, loose, and easily detached; flesh, juicy, sweet, and fragrant; seeds, few; division, very loose and regular; rag, very loose in centre. Use: Dessert. Tree good bearer.



Common Seville. Pomelo. Maltese Blood. Ruby Blood.

PLATE 5.



Homosassa. Paramatta. Mediterranean Sweet. Sweet Seville.

PLATE 6.

Citrus Nobilis—continued.

Emperor Mandarin. Plate 7. Fruit, firm, medium, flattened; rind, orange, loose, thin, and easily detached; flesh, sweet, juicy, and melting; seeds, fairly numerous; divisions, loose, regular; rag, very loose in centre. Use: Dessert. Tree good bearer.

Thorny Mandarin.—Fruit, small, solid, and sweet. Tree, good bearer.

Beauty of Glen Retreat.—Fruit, good flavour. Tree, good bearer.

Citrus dulcis (Volkamer).

The Sweet Orange.—Trees usually of strong growth; leaves, large, oblong; petiole, winged; branches, with but few spines; flowers, white; staminate qualities, weak; fruit, round or oval; oil cysts of rind, convex. Use: Fruit, dessert; flowers, Neroli oil.

Types.—Old Mildura Seedling. Plate 8. Fruit, slightly pear-shaped, medium, firm; rind, pale orange, smooth, thin; flesh, melting, fine, and sweet; seeds, few; divisions, regular; rag, slightly loose in centre.

Wolfskill's Best. Plate 8. Fruit, round, medium, firm; rind, pale orange, smooth, thin; flesh, fine, juicy, sweet, and good flavour; seeds, few; divisions, regular; rag, somewhat loose in centre. Mr. F. W. Pickering, Old Mildura Estate, who kindly supplied me with all the types photographed, states—"This variety is a wonderfully consistent bearer, of most prolific crops, an advantage being the even size of the fruit, running, as it does invariably, about 12 dozen to the bushel case—a size favoured by the trade."

Jaffa. Plate 8. Fruit, egg shape, medium, firm, and heavy; rind, dark orange, fairly smooth, fairly thick; flesh, fine, juicy, and sweet; seeds, few; divisions, very regular; rag, loose in centre. Tree, thrifty, good bearer.

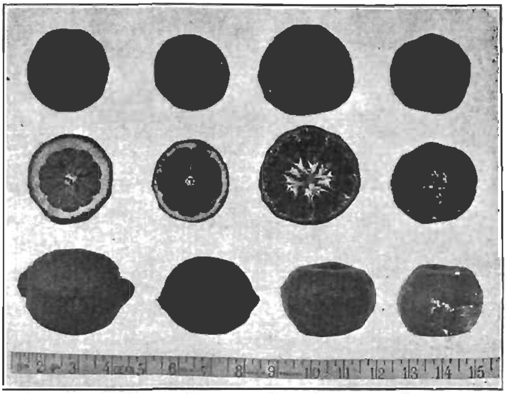
Valencia Late. Plate 8. Fruit, oblong, medium, firm; rind, pale orange, smooth, thin; flesh, melting and juicy; rag, loose in centre; seeds, very few. Tree, good bearer, thrifty; latest variety grown. Fruit will hang a long time on the tree.

Azorean St. Michael. Plate 9. Fruit, medium to large, almost round, slightly flattened at blossom end, firm, heavy; rind, orange, smooth, thin; flesh, melting, juicy, good flavour; seeds, fairly numerous; rag, slightly loose in centre. Tree, an excellent bearer, and regular.

Egg-shape St. Michael. Plate 9. Fruit, egg-shape, medium, firm; rind, deep orange, fairly smooth, and very thin; flesh, fine, juicy, sweet; seeds, few; divisions, regular; rag, slightly loose in centre.

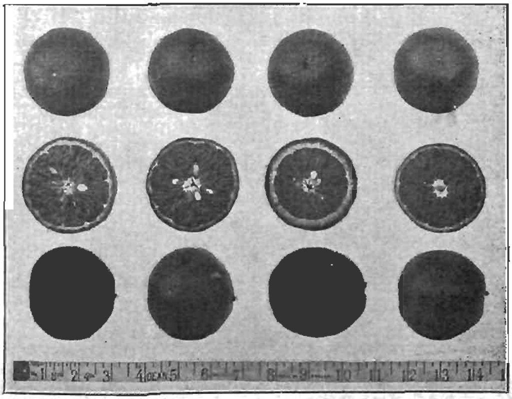
Paper Rind St. Michael. Plate 9. Fruit, small to medium, round, very firm; rind, orange, smooth, thinnest-skinned orange grown; flesh, fine, juicy, sweet; seeds, few; divisions, regular; rag, firm in the centre. Tree, good bearer.

St. Michael. Plate 9. Fruit, medium, round, firm; rind, pale orange, smooth, thin; flesh, fine, juicy, good flavour; seeds, fairly numerous; rag, firm in centre; divisions, regular.



Eureka Lemon. Lisbon. Dancy Tangierine. Emperor Mandarin.

PLATE 7.



Old Mildura Seedling. Wolfskill's Best. Jaffa. Valencia Late

PLATE 8.

Citrus dulcis—continued.

Homosassa. Plate 6. Fruit, almost round, flattened slightly at blossom and stem ends, medium to large, firm, heavy; rind, deep orange, fairly smooth, fairly thin; flesh, melting, good flavour; seeds, few; divisions, regular; rag, firm in centre. Ripens early.

Parramatta. Plate 6. Fruit, round, medium, firm; rind, deep orange, fairly smooth, fairly thin; flesh, fine, juicy, sweet; seeds, fairly numerous; divisions, regular; rag, firm in centre. Tree, thrifty, good bearer.

Mediterranean Sweet. Plate 6. Fruit, round, medium to large, firm; rind, orange, smooth, fairly thin; flesh, fine, juicy, good flavour; divisions, regular; seeds, few; rag, slightly loose in centre. Tree, good bearer.

Washington Navel. Plate 10. Fruit, more oblong than round, large, firm, heavy, with Navel marking at blossom end; rind, deep orange red, very smooth, and thin; flesh, melting, juicy, and excellent flavour; seedless; divisions, slightly irregular; rag, firm in centre. Tree, an excellent bearer, thrifty. Undoubtedly the king of oranges. Mr. F. W. Pickering, in writing of this orange, states—"I would like you to draw especial attention in your article to the advisability of cultivating the Washington Navel variety. Common oranges do not pay to export, but I am convinced there is a tremendous future before the growers of Washington Navels for export."

Thomson's Improved Navel.—Fruit, large, firm; rind, smooth, thin; flesh, melting and sweet; a very excellent Navel type.

Golden Nugget Navel and Golden Buckeye Navel.—Both recent introductions from California, and well spoken of.

Navelencia.—A cross of the Valencia Late and Thomson's Improved Navel; quality, good; fruit, late in ripening. Tree of good growth.

Australian Navel. Plate 10. Fruit, large, oblong, Navel marking large and prominent; rind, deep orange, rough, and thick; flesh, juicy, excellent flavour; seeds, occasionally; divisions, fairly regular; rag, very loose in centre. Tree, very shy bearer.

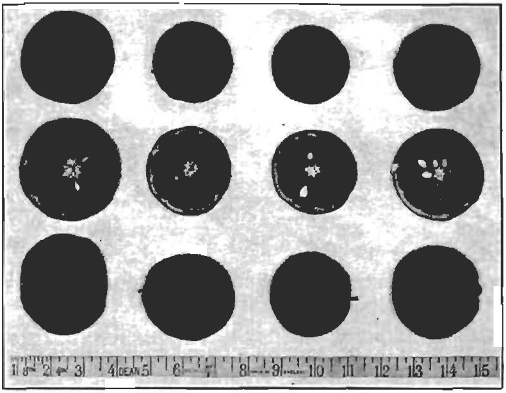
Siletta. Plate 10. Fruit, round, medium, firm, and heavy; rind, pale orange, smooth, fairly thin; flesh, fine, juicy, and excellent flavour; seeds very few; divisions, regular; rag, firm in centre. Tree, good bearer.

White Siletta.—Rind, pale orange, smooth, and thin; flesh, fine, juicy, good flavour; early.

Queen. Plate 10. Fruit, round, medium, firm, heavy; rind, pale orange, smooth, thin; flesh, melting, juicy, good flavour; seeds, few; divisions, very regular; rag, slightly loose in centre. Tree, an excellent bearer, thrifty.

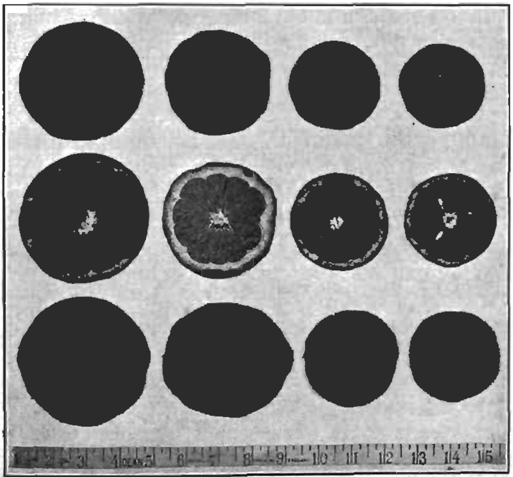
Joppa.—Tree, thrifty, excellent bearer; fruit, medium, firm, good quality.

Maltese Blood. Plate 5. Fruit, round to oval, medium, firm, heavy; rind, deep orange, with red blush on surface, fairly smooth, somewhat thick; flesh, fine, juicy, sweet, marked with a vinous red; seeds, few; divisions, regular; rag, solid in centre. Tree, good bearer, early.



Azorean St. Michael. Egg-shape St. Michael. Paper Rind St. Michael. St. Michael

PLATE 9.



Washington Navel. Australian Navel. Silletta. Queen.

PLATE 10.

Citrus dulcis—continued.

Ruby Blood. Plate 5. Fruit, small, oval, firm, and heavy; rind, deep orange, with red mottled blush, smooth, and thin; flesh, melting, juicy, vinous red, with pleasing aromatic flavour; seeds, few; divisions, very regular; rag, solid in centre. Tree, good bearer, early.

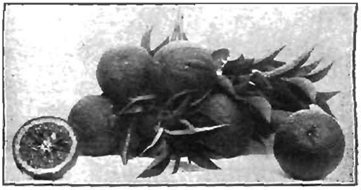


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PLATE 11.—ECHUCA SEEDLING.

Echuca Seedling. Plate 11. Fruit, round, large, heavy; rind, deep orange, rough, thick; flesh, fine, juicy, good flavour; seeds, numerous; divisions, regular; rag, loose in centre. Tree, very prolific, and regular cropper, thrifty, and very hardy. Raised at Echuca thirty years ago. From its habit and general characteristics, should prove a most useful tree for stock purposes.

Fig. 1.—Habit of producing fruit in clusters.

Fig. 2.—Blossom end of fruit.

Fig. 3.—Cross section of fruit.

Citrus Medica (Linné).

The Citron tree in its widest application. A native of Southern Asia.

General characteristics.—Tree, of medium size; branches, with spines; leaves, oblong; petiole, winged; fruit, oblong; rind, thick and tender, wrinkled or furrowed; oil cysts generally concave; flesh, firm and acid; flowers, large, streaked, and reddish on outside.

Varieties.

Citrus limonum (Risso).

The Lemon.—Tree, rapid grower, prolific bearer; branches, with spines; leaves, pale green; petiole, but slightly winged. Use: Pulp for lemon juice and citric acid, and rind for candied peel.

Types.—Lisbon. Plate 7. Fruit, medium, oblong, firm, heavy; rind, pale yellow, smooth, thin; flesh, fine, firm, and acid strong; seeds few; divisions, regular; rag, firm in centre. Tree, heavy, and constant bearer.

Eureka. Plate 7. Fruit, oblong, medium to large, firm; rind, pale yellow, wrinkled, and thick; flesh, fine, and pleasantly acid; seeds, few; divisions, regular; rag, loose in centre.

Citrus limonum—continued.

Villa Franca.—A summer-bearing variety; a very shy bearer; tree, very delicate; fruit, oblong; rind, thin; flesh, fine and acid.

Variegated (Lisbon).—Leaves variegated; tree, shy bearer; fruit, oblong; rind, thin; flesh, fine, and pleasantly acid.

Citrus limetta (Risso).

The True Lime.—A tree of straggling habit, low growth, and delicate; fruit, smaller than the Lemon; branches, with spines; rind, yellow, thin, wrinkled, and furrowed; flesh, fine, and acid. Use: Marmalade, lime juice, and citric acid.

Types.—Tahitian: Tree, strong grower, prolific bearer; fruit, fairly large; seeds few. East Indian. West Indian. Persian, or Sweet.

Citrus cedra (Gallesio).

The Citron.—Tree, fairly strong grower; leaves, oblong and serrated; fruit, oblong, large; rind, lemon colour, very thick, and tender, furrowed, rough, and warted (in some varieties smooth); flesh, fine, and sub-acid. Use: Candied and preserved peel from the inner rind. Probably the primal type of the species which produced the Lemon and the Lime.

Types.—Lemon, or Sorrento, the variety chiefly grown. Lyman, also a good variety. Bengal. Knights.

(*To be continued.*)

A PROFITABLE FARM.

By R. R. Kerr, Dairy Supervisor.

During a recent trip to Darnum, the farm of Mr. J. Gaul was visited. The farm contains 140 acres, together with about 100 acres rented, and consists of hilly ground and rich flats along the Moe River, and is well adapted for successful dairy farming.

The casual observer is at once struck with the signs of enthusiasm and prosperity that mark the farm of the successful dairyman, and his great faith in the industry. Much of the success on this farm is due to the hearty co-operation of Mr. Gaul's family, the work being proportioned amongst them. All the milk is converted into cheese for sale in the neighbouring towns and Melbourne. At present 72 cows are being milked, and yield 176 gallons a day, or an average of 2½ gallons per cow, which means, with cheese at 8d. a lb., a return of £2 10s. a month per cow. Last year 65 cows and heifers were milked, and made on an average 671 lbs. of cheese, at 6d. a lb., and, after deducting expenses in cheese-making, left a return of £16 1s. 3d. per cow. £100 was made out of pig-raising, and 20 calves from the best cows were reared, the owner refusing £2 10s. a head for them.

Mr. Gaul is a firm believer in the necessity of having one of the true dairying breeds, and not the so-called dual purpose cow, thus preventing the elements of the beef-producing interest from creeping into his dairy herd. He is of opinion that one can well afford to give the good cow away when her milking days are over; the two or three pounds

extra one receives for the beefy animal, when dry, in no way compensates for the increased production during lactation from the true dairy cow. The Ayrshire type predominates in the herd, pure Ayrshire bulls being used. Culling is systematically carried out.

Twenty-five acres of oats were grown for hay, and 25 acres of millet for summer feeding, this latter being mainly grazed by the cows, though portion was cut for hay. This was chaffed with oaten hay, and a little branning added, steamed and fed to the cows during the winter months, Mr. Gaul saying, "Feed is half the breed." The above results go to prove what can be accomplished by a little intelligent effort on the part of an energetic man, and serve as an example to the dairy farmers in general.

A NEW INSECT PEST TO ROSES.

"THE VINE CURCULIO" (WEEVIL).

Orthorrhinus Kluggi, Sch.

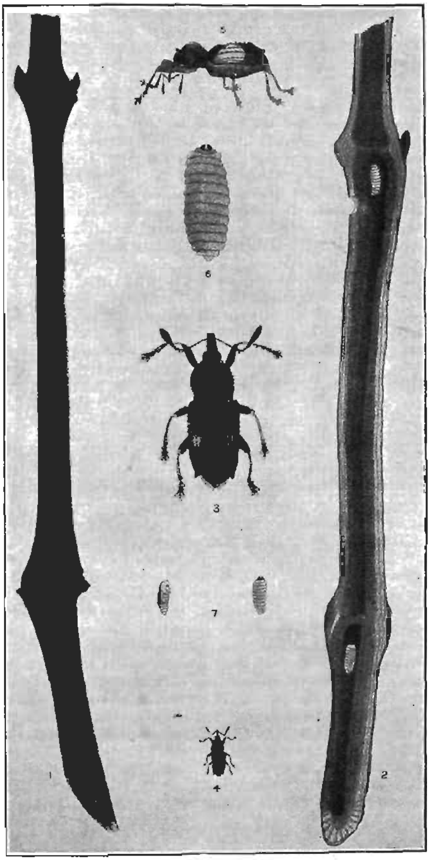
By C. French, Jun., Acting Government Entomologist.

This insect, the natural food of which is the Wattle (*Acacia*), is common in most parts of the State. During recent years it has been proved that sometimes these insects forsake their natural food and turn their attention to vines, causing considerable losses to the grower. Not content with causing damage to vines, the insects have commenced to attack roses. In July last, a correspondent residing at Horsham forwarded some rose stems which were being killed by insects. I examined the stems, and found them to be badly infested with the larva of a weevil. This being the first time I had seen weevil larvæ in rose stems, I was unable to identify the insects until I bred them out. Early in December last the perfect insects emerged, as many as six coming from a stem 7 inches long.

These insects are of a light-brownish colour, the wing cases have white tips and a greyish-white patch on the middle. The male insect is about 3 lines in length, while the female is about 3½ to 4 lines. The female deposits her eggs on the stems of rose and vine plants. When the eggs hatch out the young larvæ at once commence to bore into the stems, and soon reduce the pith to sawdust.

Mr. E. E. Pescott, Principal, School of Horticulture, Burnley, informs me that at Diamond Creek, in 1909, he saw these insects on the young terminal twigs of Jonathan apples and apricots.

As the insects deposit their eggs on the outside of vines and roses, it would be necessary to spray the plants with a deterrent such as coal tar water, the formula for which is as follows:—Boil 1 lb. of coal tar in 2 gallons of water, and while hot add from 50 to 100 gallons of water. Benzole emulsion might also be tried. This is a patent preparation, and can be purchased at any of the leading seed shops in Melbourne. One 1-lb. tin, when diluted, makes 5 gallons of spray. The smell of the benzole remains on the plants for days. All dead or dying acacias growing in close proximity to a garden should be destroyed by burning.



THE "VINE CURCULIO" (ORTHORRHINUS KLUGGI, SCH.).

BEE-KEEPING IN VICTORIA.

(Continued from page 144.)

By F. R. Beuhne, Bee Expert.

XIII.—HONEY.

Honey is the nectar of flowers which has undergone chemical changes during and after the gathering by the bees.

It is composed principally of two sugars, dextrose and levulose, and water. Several other sugars are also usually present, as well as formic acid, tannic acid, albumen, and the essential perfumes of the blossoms from which the nectar was gathered. It is the presence of these essential oils which produces such a great variation in the aroma and flavour of different honeys. All honey is liable, sooner or later, to candy, or granulate; it becomes first cloudy and gradually partially or wholly solid.

Of the two principal sugars composing honey, dextrose is a crystallizing and levulose a relatively non-crystallizing sugar, and the preponderance of the one or the other governs the rapidity and degree of crystallization; while the variation of the greater quantity of one or the other is due to the flora from which the nectar was gathered by the bees. There are, however, some other minor factors which hasten or retard granulation. These are temperature, amount of water, pollen grains, and air bubbles. Honey does not as a rule granulate till the approach of cool weather, and that gathered during cool weather granulates sooner and firmer than honey produced in midsummer. Any honey, however, will granulate sooner under frequent changes of temperature than when kept at a uniform degree, high or low.

The amount of water present in honey varies according to the source of the nectar, the humidity of the atmosphere at time of gathering, and the length of time it remained in the hives. In Victorian honey it ranges from 12 to 25 per cent., the average density being 15 to 17 per cent. When exposed to the atmosphere, the percentage of water will adjust itself to the humidity of the air; thus honey from the dry districts of the State, unless kept hermetically sealed, absorbs water from the air in the city sale-rooms and becomes quite thin on the surface during moist weather. As water is necessary to crystallization, the thinner honeys naturally granulate more readily than the dense honeys from dry districts. Some of the latter remain liquid for one or two years. Particularly is this the case with yellow box and red box honey, which, if it could be obtained entirely free from admixtures of other kinds, would probably remain liquid indefinitely.

Pollen grains, which are always present in honey, have no doubt some influence in the granulation by acting as nuclei of crystallization. At any rate, it is certain that the honey from plants producing abundance of pollen for bees, such as the redgum, grey box, and stringybark eucalypts, and white clover, cape weed, and native dandelion, granulates very quickly; while that from yellow and red box, producing little or no pollen for bees, remains liquid for a long

time. When the modern method of removing the honey from the combs by centrifugal action was first adopted, it was soon found that the air bubbles incorporated in the honey by this process caused it to granulate sooner than when the old method of crushing the combs and straining was practised. How to remove this incorporated air, and to delay granulation generally, will be dealt with in a succeeding chapter.

EXTRACTING HONEY.

Extracting the honey from the combs is in itself a simple enough operation, consisting in first slicing the wax cappings off the sealed honey-comb by means of an uncapping knife, then placing the frames, two, four, or more at a time, upright into the comb-baskets of one or other of the various styles of honey extractors, when by turning the crank handle the baskets are revolved round a central shaft inside a tin can, and the honey is thrown out from one side of the

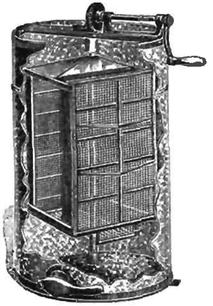


FIG. 1.—NOVICE EXTRACTOR.

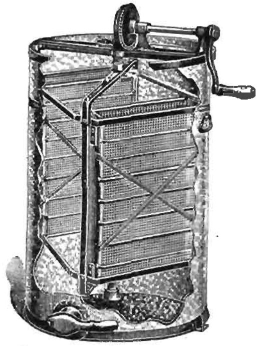


FIG. 2.—COWAN 2-FRAME EXTRACTOR.

comb against the side of the can by the centrifugal force produced. The combs are then reversed; in the smallest kind of extractor (The Novice), as shown in Fig. 1, the combs have to be lifted out and re-inserted with the opposite side facing out. In the Cowan two-frame extractor (Fig. 2), each of the comb-baskets is swung round without removing the comb; while in machines of four or more comb capacity the baskets are connected by a sprocket chain (Fig. 3), and the reversing of one will reverse all the combs. In the latest type of extractor the reversing of the driving gear automatically reverses the combs. In large apiaries in the best honey districts petrol engines are used to drive the extractors, the reversing action being obtained by means of the slip gear, which causes either the one or the other of the bevelled cog wheels seen on top of the extractor in the illustration (Fig. 4) to grip the horizontal cog of the centre shaft, and thus drive the reel with the comb-baskets in either a right or

left hand direction, the comb-baskets being automatically reversed at the same time. By using a power-driven extractor, cappings melter, honey ripener, and a system of gravitation from the extractor to the settling tank, three men can easily take 1 ton of honey in a day of ordinary working hours. As it often happens during heavy honey flows that there are days when, owing to strong wind, extreme heat or cold, no honey can be taken off the hives, and yet the bees continue to bring it in notwithstanding these drawbacks, it becomes necessary to get a maximum of extracting done while conditions are favorable for this operation, so as to provide storage room for the bees and to prevent them gluttoning the brood combs with honey. With several hundred colonies in a good locality, the additional yield obtained will more than cover the cost of engine, reducer, honey heater, &c., in one season.

For apiaries of up to 100 colonies in ordinary average localities, a Cowan two or four frame extractor, driven by hand (Figs. 2 and 3),

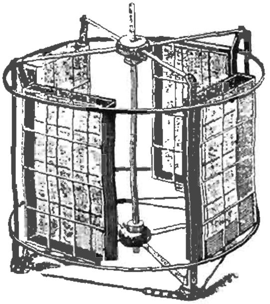


FIG. 3.—REEL OF FOUR COMB REVERSIBLE EXTRACTOR.

will be sufficient. When only a few colonies are kept, without any prospect of increase owing to the character of the locality, a Novice extractor (Fig. 1) will answer all requirements. To any one, however, commencing bee-keeping anywhere with the intention of gradually increasing the number of hives and moving to a suitable locality I would recommend obtaining a two-frame Cowan reversible at the start, as the difference between it and the Novice is not more than 10s. to 12s. 6d.

Whatever kind of extractor is used, the same general rules will apply; but it should be borne in mind that the smaller the diameter of the extractor the faster it has to be turned to remove the honey from the combs, and the more liable are the latter to fracture, because the nearer the comb is to the centre shaft the more divergence there is in the direction of the centrifugal force acting on the comb at different points.

When inserting uncapped combs into the extractor-baskets or withdrawing empty ones, it should be done without brushing against

the wire screen, otherwise the cells will become burred, preventing the honey coming clean out of the cells, and causing unnecessary work to the bees. This bruising of the cells will also occur in uncapping the combs when the combs are tough and the knife blunt. The uncapping knife should be as sharp as a razor. Extracting combs should be straight, and present an even surface after being uncapped, so as to rest evenly against the wire screen of the extractor-baskets.

Before extracting is commenced the honey should be properly ripe.

Unripe honey is inferior in density and flavour, granulates sooner, and, when too thin and containing tannic acid, will even become very dark when it comes in contact with iron. Most Australian honeys contain tannic acid in traces; but, when properly ripe, the acid does not act on the iron of the tins. No general rule can be laid down as to when honey is ripe; it depends upon the source from which

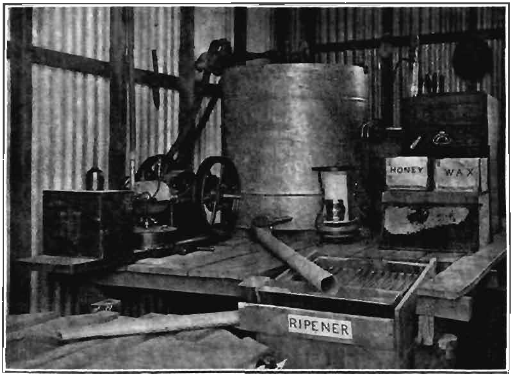


FIG. 4.—EXTRACTING PLANT OF LARGE MODERN APIARY.

the bees gather the nectar and the degree of humidity of the atmosphere at time of storing by the bees.

While honey from different plants varies considerably when fully ripe in the percentage of water it contains, ripe honey from one and the same source, but gathered in different localities, or even in the same locality but under different atmospheric conditions, will contain water in varying proportions.

During the summer months, in districts north of the Dividing Range which have a rainfall not exceeding 30 inches, honey is considered ripe when the combs have one-half to two-thirds of their surface capped over by the bees. In the country south of the Divide, and in districts with a heavy rainfall, it is better to leave the combs on the hives till nearly capped all over. This also applies to the northern districts during early spring and late autumn.

On the other hand, during very dry weather honey may become over-dense and difficult to extract, even when not sealed. This sometimes occurs when a cold change, without rain, follows hot weather with a good honey flow. It is always best not to take off honey when the weather is cold, unless it is unavoidable. The combs must then be stored, and the extracting done in a warm room.

Beginners often have difficulties through damaging the combs whilst in the extractor. This may result from several causes; the honey in the combs may have been too cold, the extractor may have been turned too fast at the start, the combs may have been too warm and soft, or the frames may not fit evenly against the wires of the extractor-baskets.

It must here be pointed out that there is at least one kind of honey which cannot be removed from the combs by extracting; it is that gathered from one of the ti-trees (*Leptospermum scoparium*) found

FIG. 5.—AN APIARY IN IDEAL BEE COUNTRY.

near the coast and in wet places elsewhere. In some localities it is known as wild may. The honey from this plant is very dark, strong-smelling, and rank in taste, and fit only for manufacturing purposes. The class of country producing this kind of honey should be avoided by bee-keepers. When, however, it occurs in belts in some of the best redgum and box districts, it provides a valuable stand-by for the bees during the "off" season. This honey, although it appears very dense, really contains a high percentage of water, but after being stored in the cells it sets like jelly, so that it can be removed with a pin in one piece. The only way of getting it from the combs is to cut them out, and melt and separate in a cappings reducer; better use can, however, be made of it by reserving it for the bees as winter food, provided that it is not the only crop of the locality.

Honey from the red box eucalypt is very dense, and it is almost impossible to extract it without damaging the combs once it has been

allowed to become cold in the combs. In a lesser degree this may also be said of yellow box honey. To extract dense honey without damaging the combs the extractor should be turned slowly till about half the honey of one side of the combs has left the cells; the combs are then reversed and the speed increased till that side of the combs has been emptied. Then the combs are again reversed, when the honey left in the cells on the other side is thrown out.

(To be continued.)

THE VALUE OF FRUIT AS AN ARTICLE OF DIET.

By Dr. J. H. L. Cumpston.

Before any estimate of the value of any particular article of food can be attempted, it is essential to obtain a clear idea of the reasons why food is necessary, of the requirements that a perfect article of food must satisfy, and of the way in which food becomes available for use by the body.

The Reasons why Food is Necessary.

Without discussing too fully the intricacies of the subject, it may be accepted that the discharge of all the functions of the body—the beating of the heart, the processes of thought, the contractions of muscles which cause movements, and so on—can only be accomplished by the expenditure of a certain amount of energy. This energy is provided by a corresponding actual loss of substance by the body tissues. Therefore to make good this loss of substance, which goes on incessantly from the moment of conception till the hour of death, and to thus maintain the body in normal working condition, fresh supplies of material must be forthcoming. The food we eat provides the supply. While this actual loss of substance must be made good, there is also during the earlier periods of life a constant growth of all parts of the body. So that the food must be supplied with the double object of replenishing the loss by "wear and tear," and also enabling the body to grow.

The Requirements that a Perfect Article of Food must Satisfy.

In the first place, as has just been said, the substance actually lost must be replaced. So that the first point to be considered is to ascertain quite clearly what substances are lost from the body as a result of the performance of its functions. This has been experimentally investigated, and is now quite decided. The avenues by which the loss occurs are the lungs, the skin, the kidneys, and—to a less extent—the bowels. Analysis of these waste products shows that they consist almost entirely of four chemical elements—carbon, hydrogen, oxygen, and nitrogen—and that the proportions of these various substances remain fairly constant. Therefore, the main problem to be solved is how to supply these four elements in the proper proportions.

Food in the forms in which it is universally taken may be classified under five definite heads, according to its composition. These

groups are named as follow:—*Proteids, carbohydrates, fats, salts, and* water. Of these, water, a familiar enough substance, plays the most important part. The proteid group is the only one of these which contains the necessary nitrogen, and may be represented by the white of an egg, which is the purest form of proteid among the common articles of diet. The lean part of meat is another example of a proteid form of food. The term "fats" sufficiently explains itself—butter and the fat of meat are common examples. Carbohydrates are a group of substances all alike in chemical composition, but somewhat unlike in the forms in which they are familiar to us. Potatoes, flour, and sugar are all examples of the carbohydrate type of food. Salts form a small portion of food; there are a large number of them, and the most familiar example is ordinary table salt.

So that, in an ordinary breakfast, the chop is the proteid, the bread and the sugar in the jam are carbohydrates, the butter is the fat, the salt is used with the chop, and the water is provided by the tea.

As proteids are the only food substances which contain nitrogen, it is obvious that life could not be maintained unless proteids are taken. Proteids, however, contain less carbon than nitrogen, so that if proteids alone were eaten in order to obtain the necessary amount of carbon, far too much nitrogen would be taken. A mixed diet is therefore absolutely necessary, and for other reasons a mixed diet, such as is usually taken, containing all five groups of substances, has been shown to be the most satisfactory. Science has thus been able to prove in this century that mankind has been eating the proper kinds of food since the beginning of time.

THE WAYS IN WHICH FOOD BECOMES AVAILABLE FOR USE BY THE BODY.

For the food substances to be of any use to the body tissues, to the muscles for example, it must be carried to the muscles by the blood. To get into the blood, it must pass through the walls of the intestines in a liquid or dissolved form. Obviously, in the form in which food is taken into the mouth, it would be absolutely impossible for it to pass through the walls of the intestines. Therefore, the digestive apparatus has been provided. The teeth break up the food into small particles; then the digestive juices in the mouth, stomach, and intestines mix with the food and chemically change it, dissolving it and ultimately converting it in such a way that it can pass through into the blood and be at once available for use by the tissues. It has been long understood that unless each minutest part of the food is reached and acted upon by the digestive juices the process of digestion will not be complete.

Having then considered food in general, it becomes possible now to discuss fruit in particular, and to attempt to estimate the value of this class of foodstuff. In the first place, are the different groups of food substances which have been shown to be necessary contained in fruits, and if so in what proportions are they present? Considering the commoner varieties of fruits—apples, pears, plums, peaches, apricots, cherries, grapes, gooseberries, currants, &c.—it is found that these contain about 85 per cent. of water, a very low proportion of proteids, a moderate amount of carbohydrates, and in addition to these a considerable proportion of vegetable acids and of salts. They contain no

fats. The fact that fruits contain a low proportion of proteids at once makes it clear that fruit would not be sufficient by itself to carry on the work of the body; but as fruit contains carbohydrates, salts, and a large amount of water, it takes its place as a possible constituent in a mixed diet. The fact that the carbohydrates and salts are, to a *large extent, contained in the water, i.e.*, as juice, and are thus present in a readily available form, greatly adds to the value of this form of diet. In short it is evident that fruit by itself is insufficient to maintain life for any prolonged period, that it takes its place along with an infinite variety of other foods as a pleasant and palatable form in which some of the necessary food substances may be taken; but that, unless it can be shown that fruit has in itself a special quality which is not possessed by other foods, then it must be considered that fruit is not an indispensable article of diet.

HAS FRUIT SUCH A QUALITY?

Let me remind you of what is a familiar fact—that outbreaks of scurvy on shipboard very rarely occur when the ship is provided with a sufficient supply of fresh limejuice. Without entering at any length into the theory of the question, it may be said that scurvy and some other diseases are probably due to an increase in the amount of acid in the blood, and that this increase of acidity is prevented by the vegetable acids and their salts. Though this appears paradoxical, yet in all probability it is actually so. In any case, whatever be the physiological explanation, the fact remains that the absence of fresh fruit or fresh fruit juices from the diet may lead to serious derangement of health.

In another direction fruit plays a very useful part. If a small piece of meat is placed in the juice of a fresh pineapple, the meat will gradually disappear—it is digested by a special constituent of pineapple juice. This special principle is called a ferment. Such ferments are present in all fresh fruits, and play a very considerable part in maintaining normal health. In still a third direction fruit has a special value. The cells of all varieties of fruit are encased in a fine envelope of woody fibre, known as cellulose. This is indigestible, and without producing the abnormal condition known as indigestion, it stimulates the walls of the intestines, increasing their activity, and so preventing constipation. This tendency is assisted by the large proportion of salts present in the juices, so that fruit is especially valuable in preventing constipation and assisting normal and regular digestion.

There is no doubt then that fruit has a special value as an article of diet, and is therefore practically indispensable. Particularly is this true in tropical and semi-tropical countries. The conditions of life in these countries are such that fruit is of almost inestimable value in the preservation of health. Different climates demand different diets. The Esquimaux find it necessary to consume enormous quantities of meat, and practically no other kinds of food. From this extreme, gradations are observed, until the races in tropical countries live almost entirely on fruit and grain, and have a minimum of flesh foods. In these States the climate is tropical and semi-tropical, and temperate.

and it should be emphasized that here the more fruit a man eats the better will his health be.

A word as to the effect of cooking on fruits In cooking, the cellulose walls of the cells are ruptured and the cell contents escape, so that it is more easy for the digestive juices to mix with cooked fruit than with raw, and therefore digestion is easier. On the other hand, most of the valuable constituents of fruit are present in the juice, and this becomes largely available during mastication, so that the necessity for perfect digestion is not so great as with some other foods. Further, the effect of cooking is to destroy the ferments, and so one of the most valuable constituents of fruit is lost. Therefore, while cooked and preserved fruits are good, raw fruit is probably a great deal better.

To sum up the position, then: Fruit contains some of the necessary constituents of all foods, and is therefore and by reason of its palatability, *of general value; it contains certain special principles which* are necessary to the body, and is therefore indispensable; it is of greater value in the raw than in the cooked state; it is of especial value in tropical and sub-tropical countries.

In view of these facts, it is obvious that an abundant supply of fresh fruit, sold at such prices as to be available to all, is an absolute necessity in a place with a climate such as we have.

While the reasons for it may be open to discussion, yet this fact is undeniable, that the price of fruit is maintained at such a level as to place it beyond the reach of those to whom an abundant supply would be most valuable. If it be that the fruit market is being financially exploited by the few to the detriment of the many, then these few should be forcibly reminded that financial exploitation of goods is less defensible when it controls foodstuffs needed by the people than in any other field of operations, and must inevitably bring about its own adjustment. Whatever be the direction in which the reform is called for, it is to be hoped that before long such steps will have been taken that the general public will have been provided with a sufficient supply of wholesome fresh fruit at a reasonable price.

ORCHARD AND GARDEN NOTES.

E. E. Pescott, F.R.H.S., Principal, School of Horticulture, Burnley.

The Orchard.

FRUIT.

With the exception of the very late varieties, all fruit has now been gathered, and the fruit rooms and stores are all filled with the produce of the orchard. The fruit room should be well ventilated and aired, but all direct currents of air should be avoided, as these will certainly shrivel and dry the fruit. The store room should also be kept as cool as possible. Every care should be taken to keep out of the store room

all fruit infested with any pest or disease. Such fruits should be immediately destroyed, preferably by being cooked for animal consumption.

Such varieties as Rokewood, Schroeder's Apfel, Shockley, Rome Beauty, Stone Pippin, Granny Smith, and Mellon's Seedling are all good keepers, and useful for storage purposes. The latter apple is winning its way among orchardists, and it is a desirable apple for the late local markets. In its natural home, at Dunolly, where it was raised some years ago, it keeps very late, and, in many instances, is quite sound early in November. In other districts, and grown on richer soils, it does not seem to retain its keeping characteristics. Another point in its favour is that at present it has shown no signs of Bitter Pit.

New Pear.

Alama.—Resembling Easter Beurre very much in appearance, with a considerable amount of russetting near the stalk. Greenish-yellow in colour, well fleshed, core small, flavour second rate, fairly mealy, and not a good keeper.

Cultivation and Green Manuring.

The heavy rains of March have made cultivation very easy this season, and growers are enabled to get in early crops for green manuring. As soon as the fruit is off the trees, the land should be well ploughed and left in a rough condition until the spring ploughing.

If not already done, and the orchard conditions demand it, there is still time to put in a leguminous crop for green manuring purposes. But this should be done as early as possible, so as to give the crop a chance to make some good early growth. Soils deficient in lime or in organic matter are always benefited by a crop of green manures. Where stable manure is unprocurable, the green manure crop is the only means of adding any organic matter to the soil.

Pests and Diseases.

All codlin moth bandages should be removed after the ploughing, and burned. It is not advisable to remove them before ploughing, as some larvæ certainly shelter under clods, and in the soil; the cultivation disturbs them and causes them to find a fresh hiding place.

All secondhand and old cases should be thoroughly overhauled. It is preferable to do this work now, instead of leaving it till spring, when the rush of other duties will certainly prevent it being carried out. The cases, if not bad enough to be destroyed by fire, should be dipped for some time in boiling water. And this is not only for the killing of the codlin larvæ, but also to destroy larvæ or eggs of any scale or aphis, and also any spores of fungus diseases that may have found lodgment therein.

As soon as the trees have shed their foliage, they may be sprayed with red oil emulsion for woolly aphis, peach aphis, and the bryobia mite (red spider). And this should be done before pruning, so that in handling and carrying the prunings the pests will not be spread about the orchard to infect the clean portions.

Flower Garden.

The copious rains of March have brightened up the flower gardens wonderfully, and just at this time they should be bright and gay with autumn flowers and foliage. The garden can generally be depended upon to make a good show in the autumn months, provided that the plants have been previously kept in a healthy state by watering, mulching, and feeding. The question of plant foods should be given far more consideration in autumn than at any other time of the year. Not only because the most popular flowers—roses, chrysanthemums, and dahlias—are then in vogue, but more because the soil requires a stimulus and in addition after the trying, heating weather of summer, and also after the leaching or soil washing effects of the frequent summer waterings. So that, in order to impel our rose bushes, our chrysanthemum, and other plants to give their best results, they should be fed weekly with liquid or chemical manures up to the time of blooming. Then the feeding should cease, as the plants require no further stimulus.

The removal of permanent shrubs and palms, and the planting out of evergreen trees, shrubs, and herbaceous divisions should not be delayed any longer. The nursery section of this class should be cleared out into the garden at once. It is a mistake to wait, as many growers do, for the removal of such plants until the winter season. If planted out now while the ground is warm, the roots of the plants have a fair chance to grow, to take a considerable hold of the soil, and to establish themselves in their new location before the growth period ceases. Then, after the winter's rest, they are ready to break away into new growth, both in the roots and crown, with the advent of the first spring weather. When planted in winter they have no chance to grow, the roots remain as when planted and with every chance to rot in the cold wet soil, the foliage becomes yellow and debilitated, and the plant, if it does not succumb, often takes the whole ensuing season to recover its general health. And then, of course, the season that has been lost can never be regained.

Gardens should now be well drained or trenched. This is a feature more often overlooked than otherwise. And yet no garden will produce the results it should produce unless one or both of these very necessary operations are carried out. There is a wealth of plant food and food supplies below the usual digging depth, and gardeners should never neglect to dig down deeply, so that the roots of their plants may have an increased area in which to revel for food and moisture. Deep working is an absolute essential in every garden. It means a saving of water and manures for the grower, and it also means increased growth, health, and blossoms for the plants. The ground should always be well dug to the full depth of the soil once a year, and an occasional stirring of the sub-soil is also invaluable. A mistake often made is that the clay is brought to the surface, and the top soil buried beneath it. Nature's order should never be reversed, and the relationships of top soil, and then sub-soil, should always be recognised. After the autumn digging, the ground may be left in a fairly rough state, as the usual climatic conditions will result in a gradual

weathering down of the surface. The autumnal dressing of lime is always beneficial.

Bulbs, tubers, and corms of spring-flowering plants should now all be planted. As they appear above ground, they should be protected from the ravages of snails and slugs, as these pests have a very great liking for such succulent growths. A good surface dressing of broken leaf or dust tobacco will effectively deal with these pests. In fact, the gardener who constantly uses tobacco, either in the leaf, stem, or dust form, will very soon be in the happy position that slugs and snails will cause him no anxiety whatever. Besides, the tobacco has manurial properties which also are valuable.

Pansy and any other seedlings, also rooted layers and cuttings, may now be planted out into their permanent positions.

Sowings may also be made of any hardy annuals, such as antirrhinum, aquilegia, coreopsis, Canterbury bell, dianthus, everlastings, foxglove, gaillardia, hollyhock, larkspur, leptosyne, lobelia, marigold, pansy, petunia, stock, sweet peas, verbena, wallflower, &c.

Vegetable Garden.

There should now be no untidy or undug plots in the kitchen garden. The vacant beds should all be well dug over and prepared for the planting of vegetables for use in spring. In digging, a top dressing of manure should be given; this may be dug in. All weeds, too, may be forked into the trenches, and covered well with soil as each spit or length is dug. A dressing of lime is very beneficial at this time of the year.

A start should now be made at cleaning out the asparagus beds. This vegetable is most popular, and yet one rarely met with in ordinary household gardens. It is supposed to be difficult to grow, but this supposition is not borne out, as, once established, a bed of asparagus is one of the most easily managed plots in the whole garden. Depth of good soil and plenty of manure are all that this plant requires.

In establishing a new bed, it is advisable to see that there is a good depth of 2 or 3 feet of rich, well manured soil. If this is not present, the soil should be dug out to that depth, and thoroughly mixed and enriched with well rotted manure before being replaced. A bed deeply prepared, and supplied with ample quantities of manure, should last without replanting for very many years. The young plants or crowns, should then be planted in trenches, keeping the rows 2 or 3 feet apart. An asparagus bed requires ample and direct exposure to the full rays of the sun. The asparagus should not be cut during the first season after planting. In fact, it is better to allow it to go uncut for two seasons. As little foreign weed growth as possible should be allowed in the beds, but, when they are not producing culinary asparagus, rows of lettuce, beans, radish, &c., may be grown between the crowns.

Towards the end of April the tops may be cut down, the beds cleaned, and a good top dressing of stable manure given. Chemical fertilizers, such as bonedust, sulphate of ammonia, and sulphate of potash, may be given as a substitute to organic manure. In the past

it has been the custom to annually top dress the beds with salt. It was supposed that, as asparagus in its native habitat was usually found in sandy soils near the sea coast, the plant required salt or a saline soil to produce successful results. It has latterly been found that salt is not at all essential to good growth, and that the plant will readily adapt itself, and grow well, in soils of not at all a saline character. Where potash has taken the place of salt, quite improved results followed.

It is a good rule to observe that no ripe seeds should be allowed to fall on to the beds; they should be stripped off the plants before they have a chance to drop. Seedlings will become a nuisance in the beds, and they interfere with the regularity of the rows.

A few early peas, also some broad beans, may now be sown; cabbage, cauliflower, and other seedlings should be planted out from the seed beds. All garden salads, such as thyme, mint, horse-radish, sage, &c., as well as rhubarb, should be divided and planted out where necessary.

Onions seeds for an early crop may be planted out towards the end of the month. Brown Spanish is very hard to beat as an all-round onion, while the new variety of Early Brown Spanish may be relied upon to produce an early crop.

SECOND VICTORIAN EGG-LAYING COMPETITION, 1912-13.

MONTHLY REPORT ENDED 14TH MARCH, 1913.

H. V. Hawkins, Poultry Expert.

Following my last report, the birds have had a trying time. During the early part of the month great humidity was experienced, which forced many of the hens into an unusually heavy moult, in several cases the birds dropped nearly every feather.

During the latter portion of the period cold weather, accompanied by gusty winds, has not improved the chances of several pens which are among the leading ten. There is no doubt that the variations of temperature during the moulting season have a bad effect on the organs of reproduction, and probably Mr. Brown's team, which has laid a splendid sized egg, and at fairly regular periods, for the past 10½ months, will receive a check; if so, their chance of holding pride of place throughout the competition is reduced, whilst with Messrs. Bradley and Waldon's birds, the moult has been more gradual, and their output has not diminished to any extent. There is evidence of a close finish between the first three pens.

Feeding.—During the cold snap the feed has been given hot in the morning, and at night maize has formed the bulk of the grain fed. The total number of eggs laid to date is 77,806, and the general health of the birds is good.

The competition will terminate on the 14th April, and on the 15th idem the third competition will commence.

SECOND VICTORIAN EGG-LAYING COMPETITION, 1912-13.

Commencing 15th April, 1912.

CONDUCTED AT BURNLEY HORTICULTURAL SCHOOL.

No. of Pen.	Breed.	Name of Owner.	Eggs laid during competition. April 15 to Feb 14.	Feb. 15 to Mar. 14.	Total to Date (11 months).	Position in Competition.
40	White Leghorns ..	S. Brown	1,318	96	1,414	1
47	.. ..	J. E. Bradley ..	1,235	126	1,361	2
20	.. ..	E. Waldon ..	1,246	100	1,346	3
31	.. ..	G. Edwards ..	1,229	93	1,322	4
25	.. ..	R. L. Appleford ..	1,195	118	1,313	5
70	.. ..	C. J. Beatty ..	1,184	115	1,299	6
28	.. ..	F. G. Eagleton ..	1,198	97	1,295	7
38	.. ..	H. McKenzie ..	1,163	125	1,288	8
23	.. ..	W. McLister ..	1,178	99	1,277	} 9
39	.. ..	W. G. Swift ..	1,170	107	1,277	
62	.. ..	R. W. Pope ..	1,203	73	1,276	11
1	.. ..	J. Campbell ..	1,173	102	1,275	12
45	.. ..	Wooldridge Bros. ..	1,151	109	1,260	13
13	.. ..	W. B. Crellin ..	1,168	78	1,246	14
37	.. ..	C. B. Bertlesmeier ..	1,177	63	1,240	15
[illegible]	.. ..	R. Moy ..	1,133	105	1,238	16
68	.. ..	Percy Walker ..	1,126	108	1,234	17
58	.. ..	H. Hodges	1,131	102	1,233	} 18
9	.. ..	J. Spotswood ..	1,159	74	1,233	
49	.. ..	W. Purvis ..	1,142	88	1,230	20
29	.. ..	J. B. Brigden ..	1,133	89	1,222	21
5	.. ..	J. H. Brain ..	1,089	122	1,211	22
44	.. ..	A. W. Hall ..	1,097	113	1,210	23
24	.. ..	Sargenfri Poultry Yards	1,120	83	1,203	24
48	.. ..	Griffin Cant ..	1,118	77	1,195	25
14	.. ..	J. H. Wright ..	1,108	83	1,191	26
32	.. ..	S. Brundrett ..	1,060	115	1,175	27
50	.. ..	A. Alpee	1,072	97	1,169	28
7	.. ..	A. H. Padman ..	1,073	95	1,168	29
19	.. ..	Cowan Bros. ..	1,057	109	1,166	30
46	Black Orpingtons ..	H. A. Langdon ..	1,059	103	1,162	31
10	R.C. Brown Leghorns	S. P. Giles ..	1,059	98	1,157	32
2	White Leghorns ..	B. Rowlinson ..	1,056	96	1,152	33
61	Black Orpingtons ..	Jas. Ogden ..	1,057	93	1,150	34
69	White Leghorns ..	Morgan and Watson ..	1,050	99	1,149	35
42	.. ..	Mrs. Kempster ..	1,054	88	1,142	36
64	.. ..	H. Merrick ..	1,049	83	1,132	37
35	.. ..	C. H. Busst ..	1,039	92	1,131	38
12	.. ..	T. H. Stafford ..	1,019	105	1,124	39
15	.. ..	Mrs. Steer ..	1,040	81	1,121	40
6	.. ..	J. B. McArthur ..	1,060	56	1,116	41
3	Black Orpingtons ..	King and Watson ..	1,006	102	1,108	42
51	White Leghorns ..	H. Hammill ..	1,007	91	1,098	43
57	.. ..	B. Walker ..	978	112	1,090	44
66	.. ..	M. A. Monk ..	1,004	85	1,089	45
65	.. ..	A. H. Thomson ..	990	91	1,081	46
43	.. ..	G. Purton	981	97	1,078	47
30	.. ..	Mrs. Stevenson ..	1,024	52	1,076	48
60	.. ..	Miss B. E. Ryan ..	975	80	1,055	49
66	.. ..	J. Moloney ..	958	83	1,041	50
27	.. ..	E. Nash	942	89	1,031	51
56	Brown Leghorns ..	J. Matheson ..	920	102	1,022	52
4	White Leghorns ..	J. Blackburne ..	949	72	1,021	53
11	Black Orpingtons ..	T. S. Goodisson ..	957	58	1,015	54
54	White Leghorns ..	F. R. DeGaris ..	930	76	1,006	55
16	Silver Wyandottes	R. Jobling ..	917	87	1,004	56
41	White Leghorns ..	A. Stringer ..	928	69	997	57
68	.. ..	W. J. McKeddie ..	902	71	973	58
8	Black Orpingtons ..	D. Fisher	891	57	948	59
21	White Leghorns ..	J. O'Loughlin ..	857	72	929	60
58	.. ..	W. J. Stock ..	875	48	923	61
67	Anconas	A. E. Manning ..	834	83	917	62
17	White Leghorns ..	S. Childs	852	64	916	63
22	.. ..	W. N. Ling ..	836	68	904	64
52	Minorcas ..	Chalmers Bros. ..	841	61	902	} 65
59	White Leghorns ..	W. J. Seabridge ..	823	79	902	
34	.. ..	R. F. B. Moore ..	806	90	896	67
18	.. ..	B. Mitchell ..	776	71	847	68
46	Old English Game	K. J. Barrett ..	761	73	834	69
26	.. ..	(Reserved) ..	—	—	—	..
		Totals ..	71,668	6,138	77,806	

REMINDERS FOR MAY.

LIVE STOCK.

Horses.—Those stabled can be fed liberally. Those doing fast or heavy work should be clipped; if not wholly, then trace high. Those not rugged on coming into the stable at night should be wiped down and in half-an-hour's time rugged or covered with bags until the coat is dry. Old horses and weaned foals should be given crushed oats. Grass-fed working horses should be given hay or straw, if there is no old grass, to counteract the purging effects of the young growth.

Cattle.—Cows, if not housed, should be rugged. Rugs should be removed in the daytime when the shade temperature reaches 60 degrees. Give a ration of hay or straw, whole or chaffed, to counteract the purging effects of young grass. Cows about to calve, if over fat, should be put into a paddock in which the feed is not too abundant. Calves should be kept in warm dry shed.

Pigs.—As recommended in Reminders for April.

Sheep.—Lambing ewes should be seen every morning, especially merinoes, if lambing to rams of British breeds. Comeback and first cross ewes commence lambing about now. Wool cleared from front and round the udders of stud merino and Lincoln ewes at time of crutching will allow of lambs getting milk quickly, when lambed in cold weather. Avoid shortage of feed in lambing paddocks, for insufficient feed causes inattentive mothers. Young sheep can now be classed. Inferior fleeced ones should be fattened for rations. Do not leave lamb marking too late. In the case of early prime lambs, the ram lambs should be castrated when a few days old, whenever and wherever they can be caught, no assistant to hold them being necessary.

Poultry.—Feed animal food to forward pullets, about ½ oz. daily, and equal parts short oats and broken maize at night. Add a little lucerne chaff and raw sliced onions to mash daily. Watch young stock for Roup (watery discharge from nostrils, with unpleasant breath). Late chicks are likely subjects. Isolate all cases, and use disinfectants freely. Keep head and throat clean by washing with either Condy's fluid or boracic acid. In cases of Chicken Pox isolate birds and apply to affected parts ointment made of sulphur, eucalyptus oil (three or four drops), carbolic acid (two drops), and a little vaseline mixed well.

CULTIVATION.

Farm.—Dig main crop potatoes. Push on with ploughing and sowing of cereal crops, including peas and beans. Green fodder (as for April) may still be sown. Land for maize, potatoes, and other root crops should be prepared and manured. *Flax may be sown. Transplant Chou Moellier and Giant Drumhead cabbage plants* in rows 3 feet apart. Complete sowing permanent pastures with grasses and clovers.

Orchard.—Plough, manure; apply lime to orchard lands at rate of 5 or 10 cwt. per acre where soil is sour. Spray trees infested with scale insects, Woolly Aphis, and Bryobia Mite with red oil or crude petroleum. Clean all rough bark from trees. Commence pruning at end of month.

Flower Garden.—Digging, manuring, and pruning; trench and drain where necessary. Dress the surface with lime. Continue to sow hardy annuals. Bury all leaves, soft-wooded cuttings, and weeds. Continue to plant spring blooming perennials and other plants. Plant cuttings of carnations and roses.

Vegetable Garden.—Cut down and clean out asparagus beds. Apply manure and lime dressings. Cultivate deeply. Plant out seedlings and early potatoes; sow peas, broad beans, carrots, and parsnips.

Vineyard.—Subsoil land for new plantations if not already done. It is very undesirable to perform this work immediately before planting. Vine-growers are warned against the too common practice of feeding off foliage after vintage. Any small advantage in the form of stock feed is only gained at the cost of a reduction in the following season's crop, owing to interference with accumulation of reserves, which continues so long as the leaves remain green. Sheep should not be allowed into the vineyard until all leaves have changed colour. Early and deep ploughing is strongly recommended. Manures should be applied as early as possible. The present season is exceptionally good for green manuring; peas, &c., for this purpose should be sown without delay.

Cellars.—Rack or fill up (preferably the former) dry wines as soon as a lighted match, introduced at bung hole, is no longer extinguished. Sweet wines should also